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MIL-HDBK-29612-2A
31 August 2001
Supersedes
MIL-HDBK-29612-2
30 July 1999

DEPARTMENT OF DEFENSE HANDBOOK

INSTRUCTIONAL SYSTEMS DEVELOPMENT/SYSTEMS APPROACH TO TRAINING AND EDUCATION (PART 2 OF 5 PARTS)

This Handbook is for guidance only. Do not cite this document as a requirement.

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FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense (DoD). This handbook provides guidance to DoD personnel on the Instructional Systems Development/Systems Approach to Training (ISD/SAT) process for the development of instructional materials. This handbook supersedes MIL-HDBK-29612-2, Instructional Systems Development/Systems Approach to Training and Education (Part 2 of 4 Parts).

2. This handbook is intended for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

3. MIL-HDBK-29612-2 is Part 2 of 5 Parts. Part 2 provides guidance that may be used by all Services for the analysis, design, development, implementation, and evaluation of instruction and instructional materials. The ISD/SAT process includes analysis of the training requirement, design of the training program, development of the products, conduct of the training, and evaluation of training programs, processes, and results.

4. Part 1, MIL-HDBK-29612-1, DoD Handbook, Guidance for Acquisition of Training Data Products and Services, contains guidance to be used by all Services for the preparation of solicitations and evaluation of solicitation responses for training. Part 3, MIL-HDBK-29612-3, DoD Handbook, Development of Interactive Multimedia Instruction (IMI), contains guidance on the application of the multimedia training courseware development process. Part 4, MIL-HDBK-29612-4, DoD Handbook, Glossary for Training, contains a listing of training terms and definitions. Part 5, MIL-HDBK-29612-5, DoD Handbook, Advanced Distributed Learning (ADL) Products and Systems.

5. Guidance provided in this handbook is not intended to supplement or duplicate policies and procedures in existing Federal, DoD, and Military Service regulations. Should a conflict arise between this handbook and any of the previously mentioned regulations, the regulations take precedence. There are numerous ways to analyze, design, develop, implement, and evaluate instruction and instructional materials. This handbook represents a sequence of events only to aid in a better understanding of the ISD/SAT process, a different sequence may be used. Various factors can affect the sequence or scope of the events.

6. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1. SCOPE

1.1 Scope. This handbook provides guidance that may be used by all Services and Industry on the Instructional Systems Development/Systems Approach to Training (ISD/SAT) process and the development of instructional materials. ISD/SAT process phases include: analysis, design, development, implementation, and evaluation. Additionally, ISD/SAT requires effort in the areas of planning and quality improvement. Training materials include an array of instructional documentation including, but not limited to, lesson plans, student guides, course control documents, and support materials.

1.2 Application guidance. This handbook is provided for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

1.3 How to use this handbook. This handbook provides general and specific guidance for developing curricula and training material. Section 4 of this handbook contains an overview of the ISD/SAT process. For a training manager, this may be sufficient guidance. For more detailed procedures, refer to sections 5 through 10 in this handbook.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are the ones that are needed in order to fully understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the latest issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-29612	Performance Specification, Training Data Products

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-1908	Department of Defense Handbook, Definitions of Human Factors Terms
MIL-HDBK-29612-1	Department of Defense Handbook, Guidance for Acquisition of Training Data Products and Services

MIL-HDBK-29612-3	Department of Defense Handbook, Development of Interactive Multimedia Instruction (IMI)
MIL-HDBK-29612-4	Department of Defense Handbook, Glossary for Training
MIL-HDBK-29612-5	Advanced Distributed Learning (ADL) Products and Systems

(Unless otherwise indicated, copies of military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein.

DEPARTMENT OF DEFENSE

DoDISS	Department of Defense Index of Specifications and Standards

DEPARTMENT OF THE ARMY

TRADOC Regulation 350-70	Training Development Management, Processes, and Products

DEPARTMENT OF THE NAVY

NAVEDTRA 130	Task Based Curriculum Development Manual
NAVEDTRA 131	Personnel Performance Profile Based Curriculum Development Manual
NAVEDTRA 134	Navy Instructor Manual
NAVEDTRA 135	Navy School Management Manual

DEPARTMENT OF THE AIR FORCE

AFH 36-2235	Information for Designers of Instructional Systems (12 volumes), as follows:
Volume 1 -	Executive Summary
Volume 2 -	ISD/SAT Automated Tools/What Works
Volume 3 -	Application to Acquisition
Volume 4 -	Manager’s Guide to New Education and Training Technologies

Volume 5 -	Interactive Courseware (ICW) Design, Development and Management Guide
Volume 6 -	Guide to Needs Assessment
Volume 7 -	Design Guide for Device-based Aircrew Training
Volume 8 -	Application to Aircrew Training
Volume 9 -	Application to Technical Training
Volume 10 -	Application to Education
Volume 11 -	Application to Unit Training
Volume 12 -	Information for Designers of Instructional Systems

(Copies of the DoDISS are available on a yearly subscription basis either from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402-0001 for hard copy, or from the Director, Navy Publications and Printing Service Office, 700 Robbins Avenue, Philadelphia, PA 19111-5093 for microfiche copy.)

(Copies of the Army Regulation are available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402-0001.)

(Copies of the Navy manuals are available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402-0001.)

(Copies of the Air Force manuals are available in CD-ROM from AETC/DOVP, 244 F Street East, Randolph AFB, TX 78150-4321, or in hard copy from Superintendent of Documents, US Government Printing Office, Washington, DC 20402-0001.)

2.3 Non-Government publications. The following document(s) form a part of the document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the latest issue of the DoDISS, and supplement thereto.

Interactive Multimedia Association Recommended Practices for Multimedia Training Portability.

(Application for copies should be addressed to the Interactive Multimedia Association, 48 Maryland Avenue (Suite 202), Annapolis, MD 21401-8011.)

2.4 Order of precedence. In an event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS AND ACRONYMS

3.1 General. Definitions and acronyms related to training are provided in MIL-HDBK-29612-4, Department of Defense Handbook, Glossary for Training.

4. ISD/SAT EXECUTIVE SUMMARY

4.1 Introduction. The purpose of this summary is to acquaint you with the fundamentals of the ISD/SAT process, describe how the process promotes effective and efficient instruction, and explain how you can facilitate successful application of the process. This summary will help you realize the importance of what can be done to contribute to the successful application of the process. Refer to Sections 5 through 10 for additional information about the ISD/SAT process and its application. There you will find detailed information about the analysis, design, development, implementation, and evaluation processes.

4.1.1 Education and training are essential. Education and training are essential for the effective operation of the Department of Defense (DoD). A major concern is whether personnel are adequately prepared to do the job.

4.1.2 Instruction is not always the answer. Instruction is not the solution to every operational problem. Instruction can only solve problems that result from a lack of knowledge and/or skill on the part of the jobholder. If a problem is caused by equipment, organizational, doctrinal, and/or other inadequacies, then instruction is not an appropriate solution. Trying to use instruction to solve such problems results in wasted training resources. The challenge is to select the solution that targets the cause of the problem.

4.1.3 ISD/SAT is the means to determine the answer. ISD/SAT is a systems approach that ensures an effective, cost efficient "training solution" when problems are determined to be caused by a lack of knowledge and skills on the part of the job performer. ISD/SAT is a flexible proven process for determining whether instruction is necessary in a given situation, for defining what instruction is needed, and for developing materials to meet the defined need. ISD/SAT enables leaders to:

a. Prepare forces for combat.
b. Ensure training is as realistic as possible.
c. Conduct training for all types and levels of war.
d. Give special attention to training for joint and combined operations.

4.2 ISD/SAT - what it is. The ISD/SAT process is an adaptation of the systems engineering process. ISD/SAT is a systematic approach to developing instructional materials by integrating the processes of analysis, design, development, implementation, and evaluation. As part of the ISD/SAT process, alternative solutions to instructional problems are considered for the purpose of arriving at cost effective solutions.

4.2.1 ISD -vs.- SAT. Both ISD and SAT use the same process of analyze, design, develop, implement, and evaluate. Within this process, the techniques and sub-processes are also similar. The major difference between the two processes is the entry point to the analysis phase.

4.2.1.1 ISD analysis phase entry point. The ISD process has traditionally been used for the development of individual type instructional programs. The ISD analysis phase entry point is at training situation, mission, or job analysis, followed by individual task analysis, and then training task analysis.

4.2.1.2 SAT analysis phase entry point. The SAT process has traditionally been used for the development of collective and individual type instructional programs. The SAT analysis phase entry point is normally at mission analysis followed by collective task, job analysis, individual task analysis, and then training task analysis.

4.2.1.3 ISD/SAT. Guidance provided in this handbook recognizes the differences in the two processes, yet treats the two processes as one. The entry point for the analysis phase is considered variable. For example, the supported mission, job, and collective tasks for a new equipment introduction may already exist. In this situation the logical start point for the analysis phase may be at the individual task analysis point.

4.2.2 Products of ISD/SAT. The goal of ISD/SAT is to optimize the training Return On Investment (ROI) by increasing the effectiveness of education and training. Examples of the products of ISD/SAT are:

a. Instructional systems based on mission and job performance requirements.
b. Courses consisting of relevant knowledge and skills instruction.
c. Graduates having the necessary Knowledge, Skills, and Attitudes (KSA) to perform the mission and/or job.

4.3 The ISD/SAT model. The ISD/SAT model is designed to represent simplicity and flexibility, so that instructional designers with varying levels of expertise can understand the model and use it to develop effective, cost efficient instructional systems. The model is composed of three distinct, yet interrelated parts. These parts are system functions, ISD/SAT phases, and quality improvement. The three parts of the model are represented in Figures 1 through 3 and are combined to provide the total picture in Figure 4.

4.3.1 System functions. Figure 1 shows the basic top-level system functions of the ISD/SAT model, the system functions are instructional system management, support, administration, delivery, and evaluation. Evaluation is shown as the central feedback "network" for the total system.

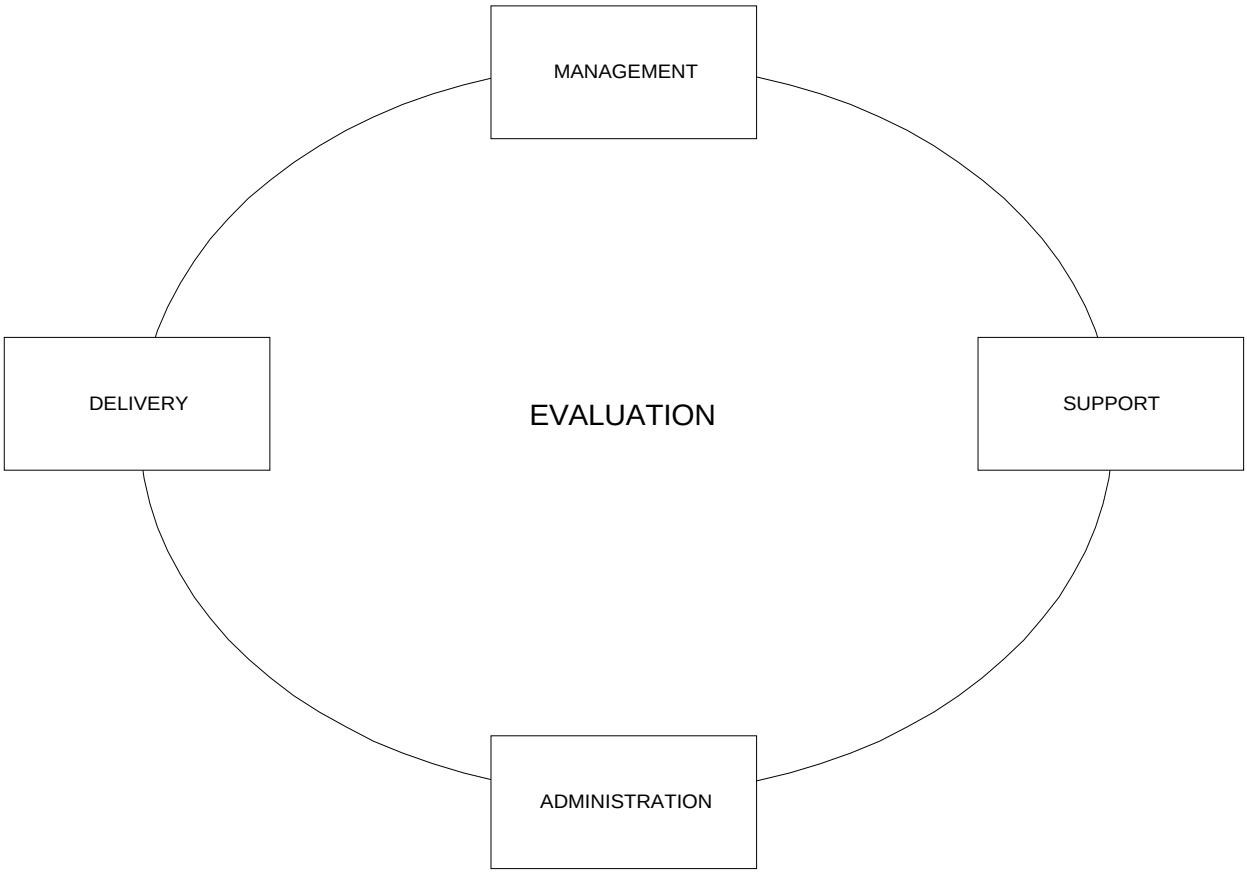

FIGURE 1. **System functions.**

4.3.2 System functions defined. The system functions of the ISD/SAT model are defined as follows:

a. Management is the function of directing or controlling ISD/SAT development and operations.
b. Support is the function of maintaining all parts of the system.
c. Administration is the function of day-to-day processing and record keeping.
d. Delivery is the function of providing instruction to students.
e. Evaluation is the function of gathering feedback data through formative, summative, and operational evaluations.

4.3.3 ISD/SAT planning. The importance of planning cannot be overemphasized. Planning the ISD/SAT structure and functions includes determining ISD/SAT process management and evaluation strategies, and estimating resource requirements and constraints. Planning also includes determining the instructional needs and concepts. Planning must take place before developing an instructional system or revising courses.

4.3.3.1 Instructional concept. The instructional system concept for a new weapon system should be developed at Pre-Milestone "0" or as early as possible. Training is a major cost driver in the life cycle of a major weapon system. Early consideration of training issues and related costs could impact weapon system design. For example it is sometimes necessary to alter weapon system design for successful integration of embedded training. The instructional concept is normally defined in Manpower, Personnel, and Training (MP&T) documents which are used in the acquisition process. The instructional system concept provides the best initial estimate of what the instruction should do and what it should look like, as well as supporting the planning of budget requirements. The total instructional system concept provides the framework for meeting instructional needs.

4.3.4 ISD/SAT phases. Figure 2 depicts the ISD/SAT phases. As shown, the phases used in the systems approach are analysis, design, development, and implementation, with evaluation activities integrated into each phase of the process. The systems approach, which the model summarizes, requires instructional designers to 1) analyze missions, platform functions, job, and/or task performance to determine what instruction is needed, 2) design instruction to meet the need, 3) develop instructional materials to support operational requirements and 4) implement the instructional system. Evaluation is a central function that takes place in every phase. Figure 2 shows that each phase of the ISD/SAT process depends on all the other phases. The ISD/SAT phases are defined as follows:

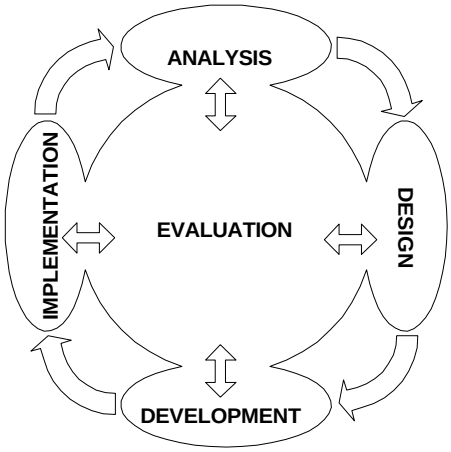

FIGURE 2. **Phases of the ISD/SAT process.**

4.3.4.1 Analysis phase. Analysis is the process used to identify critical tasks and identify the standards, conditions, performance measures and other criteria needed to perform each task. Training is based on the tasks identified in analysis. The results of the analysis phase form the basis for a training program. In courses that tie the content directly to preparing students for the performance of a mission or job, the instructional designer analyzes the mission/job performance requirements and develops a task list. (Mission/job performance requirements may also include

skills such as problem solving, leadership, and management.) During this phase, the analyst "takes apart" the required performance by looking at the mission, job, or the task itself and cataloging its parts. A result of this phase is the identification of the KSAs required for the mission/job/task performance. Then the analyst makes a comparison between the KSAs the actual jobholder must possess with the KSAs already possessed by the incoming students. The difference between what the students already know and can perform and what the mission/job/task requires them to know and be able to perform is what must be trained. The activities of formative evaluation begin during the analysis phase with process and product evaluations. See Section 6 for further details regarding the ISD/SAT analysis process.

4.3.4.2 Design phase. The instructional design is based on the analysis phase results. In this phase, the instructional designers also develop Learning Objectives (LOs), test strategy, and test items, as well as design the instruction. In the design phase, the instructional designer determines the instructional strategies and selects the instructional methods and media. Existing instructional materials (objects) and raw media are reviewed to determine their applicability to the specific instruction under development. The implementation plan for the instructional system is developed and a training information management system is designed, if required. Formative evaluation activities continue in this phase with process and product evaluations. See Section 7 for further details regarding the ISD/SAT design process.

4.3.4.3 Development phase. Instructional development is based on the design phase results. During the development phase, lesson materials, unit exercises, drills, and other instructional materials for both the student and the instructor are developed. Media selected in the design phase will be produced during this phase. As a final step in this phase, the implementation plan is updated. Instructional designers also validate all instructional materials as they are developed. See Section 8 for further details regarding the ISD/SAT development process.

4.3.4.4 Implementation phase. After the instructional system has been designed and developed, and the validation activities of formative and summative evaluation have been completed, it is time to actually implement the instructional system. In this phase, the instructional system is fielded. See Section 9 for further details regarding the ISD/SAT implementation process.

4.3.4.5 Evaluation. Evaluation is a continuous process that starts during the analysis phase and continues throughout the development and life cycle of the instructional system. Feedback from the evaluation process is used to modify the training program as necessary. To ensure continuing quality of the fielded system, operational evaluations consisting of both internal (schoolhouse) and external (field feedback) evaluations, provide the necessary periodic feedback for the life cycle of the operating system. A key element in evaluation planning is the development of metrics to support the evaluation process. There are three categories of evaluation associated with training: 1) formative, 2) summative, and 3) operational. See Section 10 for further details regarding the ISD/SAT evaluation process.

4.3.4.6 ISD/SAT activity process model. The ISD/SAT process has been documented in an activity process model. The model is provided in Appendix A.

4.3.5 Quality Improvement (QI) model. Figure 3 depicts QI as an integral part of the ISD/SAT process.

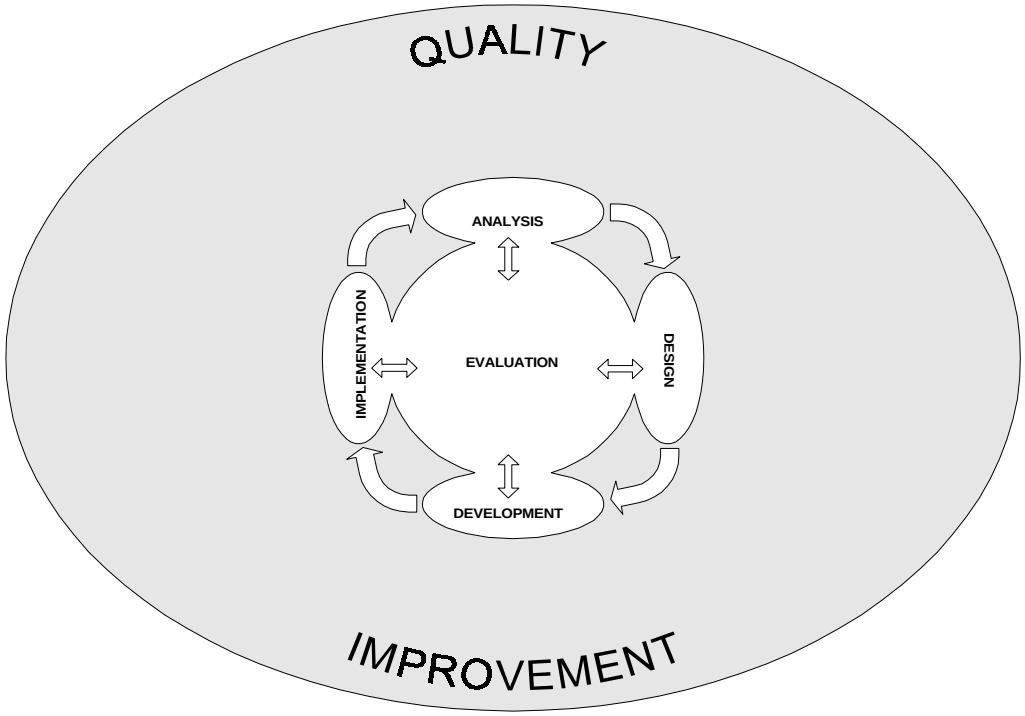

FIGURE 3. **The QI process.**

4.3.6 Total system model. Figure 4 completes the ISD/SAT model. It depicts the system functions and ISD/SAT phases embedded within the QI process. Evaluation and QI are key parts of the ISD/SAT model. Evaluation is the central feedback network for the total system.

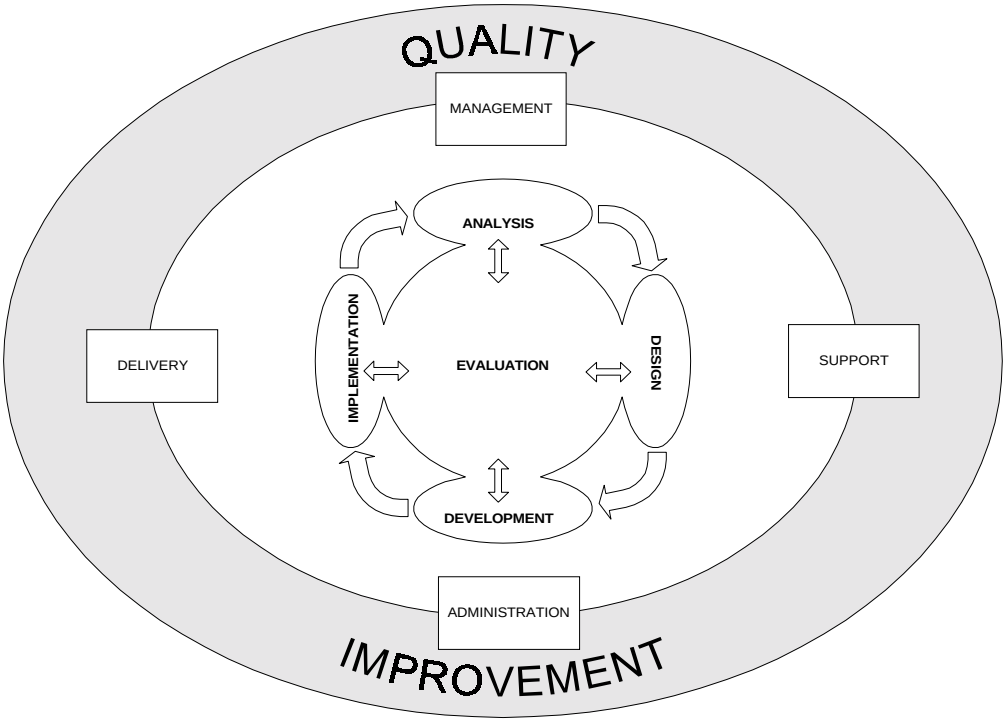

FIGURE 4. **The complete ISD/SAT model.**

4.4 Quality improvement. QI is the continuous, organized creation of beneficial change to the instructional system. The objective of QI is to foster continuous improvements in both the ISD/SAT process and the products of the process.

4.4.1 The relationship of QI to ISD/SAT. All of the principles of quality are implemented in the ISD/SAT process as represented in Figure 4. The ISD/SAT process helps ensure total quality in the education and training environment. The relationships between QI and ISD/SAT are provided in the following paragraphs.

4.4.2 The customer defines quality. The customer (operational organizations or proponent) identifies the performance requirements. Training organizations provide the instruction necessary to support the performance requirements. ISD/SAT emphasizes criterion-based instruction. The criteria are directly linked to performance requirements in the field. All evaluations are focused on the graduate and/or unit's mission.

4.4.3 Know the mission. ISD/SAT depends on mission platform functions and job analysis for the necessary data to design, develop, and implement instruction. All instruction should be based directly on mission, job, or education requirements. Mission/job analysis uses data from many sources, including mission statements found in regulations or locally developed statements. The Joint Mission Essential Task Lists (JMETL) and Service Mission Essential Task Lists

(SMETL) are important sources that should be incorporated when required. Documents defining network centric warfare are another important source for mission analysis and task definition. Analysts and curriculum developers also make use of management engineering reports, occupational data, and direct observation to determine the actual mission/job requirements.

4.4.4 Know the customers. The information gained in the mission/job analysis process gives the instructional design team information that defines the customer's expectations. By continuing to trace the relationship between the mission/job requirements and the person's knowledge and skill needed to do the mission or job, a continual focus on the actual performance requirement is maintained. In addition, the ISD/SAT process requires that the capabilities, aptitudes, and attitudes of the target audience be considered.

4.4.5 Set goals and standards. Instructional development efforts come in many variations each with their own goals and standards. The mission/job requirements and the impact of the performance deficiency determine the timing required for the development process and the conduct of the instructional program. The content of the instruction is based on the knowledge and skills needed to perform the mission/job. The design team must translate the cues, conditions, and performance standards into the instructional program.

4.4.6 Manage by fact. Each phase of the ISD/SAT process requires constant evaluation against the mission/job requirements identified earlier in the process. In addition, tools have been developed to ensure that design and development decisions are made with supporting data. For example, a number of media selection tools are being used that provide managers with information that matches media to the instructional requirements. These matches are based on learning principles and development cost factors (money and time). ISD/SAT guides the design team to develop better data upon which to base decisions that affect design.

4.4.7 Foster teamwork. An instructional program cannot be properly designed and developed in a vacuum. In order to develop effective instruction, the design team must be in constant contact with the customer. This will ensure that the instruction matches the performance requirements of the mission/job.

4.4.8 Empower your people. ISD/SAT is a problem-solving, decision-making model. Since ISD/SAT is flexible and there are any number of ways to solve a given instructional problem, a design team can be allowed freedom and given authority to design, develop, and implement instruction that meets performance requirements.

4.4.9 Integrate quality in all phases. Quality is achieved through continuous evaluation. This is true during each phase of the ISD/SAT process, from analysis through implementation. Built-in checks in each phase ensure the quality of the ISD/SAT process and instructional products with emphasis on the unit’s or graduate's performance.

4.4.10 Evaluate quality constantly. The ISD/SAT process uses a cyclic process of continuous improvement. As training developers progress through the different phases of ISD/SAT, the process and products of each phase are constantly evaluated against the instructional requirements and principles of learning. Constant evaluation after implementation identifies changes in instructional requirements due to changes in performance requirements or to personnel performance deficiencies. This results in new ISD/SAT efforts to provide the best possible instruction.

4.5 Process improvement. The basis of process improvement is Quality Management (QM). QM is a management philosophy and methodology that work together to produce continuous process improvements during the ISD/SAT phases.

4.5.1 Procedure for process improvement. In order to ensure process improvements, it is necessary to use a systematic method to identify and correct the causes of the problems in unit or job performance. The six steps of process improvement are outlined in Table 1.

TABLE 1. **Process improvement steps.**

STEP	ACTIVITY
1	Define the process and determine the main problem areas.
2	Analyze the problems and identify the causes of each.
3	Identify and evaluate possible changes to the process.
4	Implement the changes and monitor the process.
5	Institutionalize the changes.
6	Repeat for continuous improvements.

4.5.2 Ways to implement the procedure. There are many different ways to implement the basic procedure mentioned above. Two of the ways are noted below.

a. "Chart it, check it, change it" is a simple phrase that summarizes one of the ways to implement the procedure for improvement. It is a systematic approach to continuous improvement. This approach has three principal steps. They are shown in Table 2.

TABLE 2. **Chart it, check it, change it.**

STEP	WHAT YOU DO
1. Chart	• Using a process flowchart, describe the process to be improved. • Gather data on the process and its products.
2. Check	• Analyze the data to isolate the problems and opportunities. • Evaluate the process to identify alternative approaches. • Identify opportunities (i.e., useful changes) from the alternatives.
3. Change	• Improve the process by implementing changes identified as opportunities. • Institutionalize the changes through training, standardization, and other means. Then, use this process, or another process to make further improvements.

b. The Shewhart Cycle is a systematic approach to achieving a continuous improvement in quality. The cycle is a plan, do, check, and act process. Because the approach involves repetition, it is represented as a circle in Figure 5. To use the Shewhart Cycle, follow the steps listed below.

(1) Plan an approach for quality improvement. Study the process flow and any existing data. Formulate possible improvements, experiments to be run, or additional data to be gathered.
(2) Perform the planned activity. Implement the planned improvement effort. Train the people who are responsible for implementation.
(3) Check the results. Measure the results of the improvement effort that was implemented. Analyze the collected data.
(4) Act on the results. If the effort was truly an improvement, standardize and document the improvement. If it wasn't successful, determine what improvements can be made.
(5) Repeat. Continue the cycle to improve quality.

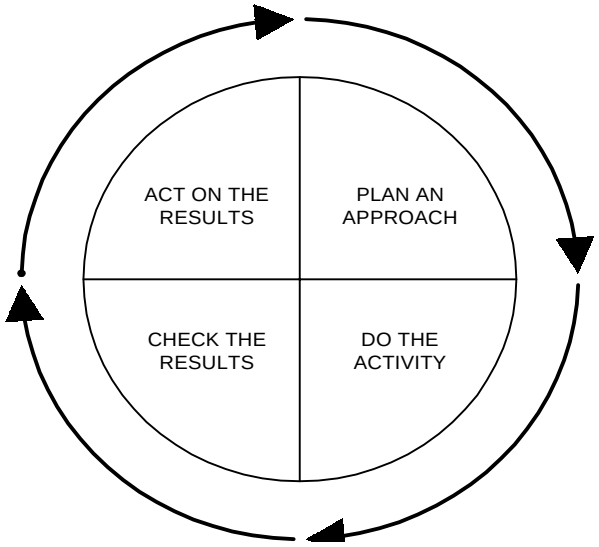

FIGURE 5. **Shewhart cycle.**

4.6 Distinctive features of ISD/SAT. The ISD/SAT process offers great potential for creativity as well as cost avoidance. This potential is achieved through application of state-of-the-art instructional technology and advances in management, communication, and behavioral sciences. Still, there are real-world constraints, therefore, compromises and trade-offs may be necessary. These are management decisions. The instructional developer who applies the ISD/SAT process is better able to present what the trade-offs involve, so managers can make effective management decisions. A manager who understands the process and makes sound, timely decisions on these matters is an invaluable asset to instructional development programs.

4.7 Effort required for ISD/SAT. From the above description of the ISD/SAT process, it should be apparent that developing an instructional system involves considerable effort. A manager may ask, "Is it necessary to invest all of this effort in every course?". Obviously, practical considerations, such as time and resources available to support ISD/SAT and the scope of the instructional requirement, dictate that the procedures and techniques described in later sections of this handbook be selectively applied. The ISD/SAT process is flexible. To successfully accomplish the ISD/SAT process, the following minimum requirements must be addressed:

a. Determine the instructional need.
b. Determine the essential mission and job tasks.
c. Determine the KSAs required to perform these tasks.
d. Determine if personnel with the necessary knowledge and skills already exist. If they do not, proceed with the balance of this list.
e. Derive LOs that, if met, would ensure satisfactory unit and/or job performance.

f. Develop test items that can be used to determine whether or not the LOs are achieved.
g. Devise the means for the unit or student to achieve the LOs.
h. Determine whether or not the unit or student has achieved the LOs.
i. Revise the instructional system as necessary if the LOs are not achieved.

4.8 Key concepts. There are several key concepts that make the ISD/SAT process distinctive. They are as follows:

a. The instructional and educational programs to be provided are determined by mission and/or job performance requirements.
b. The instructional requirements are based on an analysis that results in measurable, observable LOs.
c. The instruction is provided only on the portion of the mission, job, or education requirement that the unit or student has not already mastered.
d. Measurement is keyed to the LOs, and units or students are measured against criteria rather than in comparison to a norm.
e. The instruction is unit or student-oriented. LOs are stated in terms of unit or student performance. Instruction is also described in terms of student activity.
f. All parties know the instructional goals and when they have been attained.

4.9 Potential benefits. Years of successful demonstrations prove that competent use of the ISD/SAT process can improve instruction through effectiveness and cost efficiency in the following ways:

a. Effectiveness is obtained through use of design and development procedures, careful selection of what requires instruction, evaluation of instruction, and revision of the instructional system until it meets its objectives.
b. The ISD/SAT process helps ensure cost-efficient development of effective instruction. It cannot be assumed that application of the ISD/SAT process will always result in dollars saved. However, the process can ensure that the training programs and materials it produces fully support the training requirement with the lowest possible resource expenditure.

4.10 Responsibilities of managers. The DoD expects managers to support the application of the ISD/SAT process. It is the responsibility of managers to ensure the process is used to develop an effective and cost efficient instructional system while continually improving the quality of the process and products of the process. Managers should:

a. Rely on the ISD/SAT process to develop instructional systems.
b Ensure that sufficient numbers of competent individuals are assigned as instructional designers and managers.
c. Provide adequate training for untrained instructional designers and managers.

d. Coordinate instructional system requirements through the appropriate chain of command.
e. Provide resources (e.g., people, funds, equipment, time, etc.) to support the process.
f. Conduct periodic quality checks and eliminate instruction unrelated to the mission/job.
g. Start the initial planning for the instructional system before entering the analysis phase of the ISD/SAT process.
h. Require a course to be developed only when it is determined that, 1) there is a valid instructional need, 2) that a course is an effective, cost efficient solution, or 3) that an existing course could not fix the problem. For example, do not say: "We need a one-week course in shop safety because the accident rate in our machine shop has been increasing for the past six months." Instead, say: "The accident rate in the machine shop has been increasing for the past six months. Conduct an analysis to determine what must be done to correct the situation." If education or training is part of the solution, develop the necessary instruction.
i. Set reasonable suspense dates for development of the instructional system. Development of instructional systems can be a relatively slow process; however, there are options in the development process that will make a substantial difference in the development time. Imposing an unrealistic suspense date may force the instructional designers to bypass essential parts of the process that can cause the system to be ineffective and inefficient.

4.10.1 Data management. Program management is enhanced with a Database Management System (DBMS) that tracks training system plan milestones and reports. This DBMS provides reports on progress and justification for budget actions. The DBMS tracks the flow of the ISD/SAT process. For example a given lesson, training device scenario, or test item may be tracked to the mission, job, task, or LO requirement. A change in mission, job, or task may flag points of impact throughout the training system.

4.11 Summary. Successful mission accomplishment and job performance depends on individuals having the knowledge and skills to do their jobs. Education and training is the means of providing jobholders with these knowledge and skills. ISD/SAT is a proven effective method for the development of effective and cost-efficient instruction. Having the right doctrine, organizing the workforce effectively, providing the best equipment for the job, and selecting the best workers are also critical factors to mission accomplishment and job performance. Instructional solutions cannot solve problems caused by doctrinal, organizational, or material deficiencies. Education and training can only correct job performer knowledge and skill deficiencies.

4.12 Understanding the details. The intent of this section is to provide a concise, informative overview to the ISD/SAT process. This executive summary is not intended to provide all the information a manager needs for the successful acquisition of instructional systems. It is strongly recommended that you read and become very familiar with Sections 5 through 10. The following sections provide detailed guidance on the ISD/SAT process.

5. ISD/SAT PLANNING PROCESS

5.1 General. Planning should take place before developing an instructional system or revising existing courses. The ISD/SAT project may involve revision of an existing training program or the creation of an entirely new training program. The Program Manager for a major acquisition will require Manpower, Personnel, And Training (MP&T) analyses at each stage of the acquisition process. Figure 6 (in two parts) illustrates the types of training analysis required at each milestone of the acquisition process. ISD/SAT project planning will include ISD/SAT activities at each phase of the acquisition. The instructional developer or design team may be responsible for performing the preliminary planning activities, or some of the planning decisions may have been made by another Service organizational level. Planning should begin at needs assessment and continue through fielding of the instructional system. Although not a specific phase of the ISD/SAT process, planning is a key event and occurs throughout the process. Planning the instructional system structure and functions includes determining ISD/SAT process management and evaluation strategies, and estimating resource requirements and constraints. A management plan should be developed that identifies the objectives, constraints, and milestones of the specific ISD/SAT project. An evaluation plan should be developed to measure the progress and success of the management plan. The following paragraphs provide guidance on the ISD/SAT planning process.

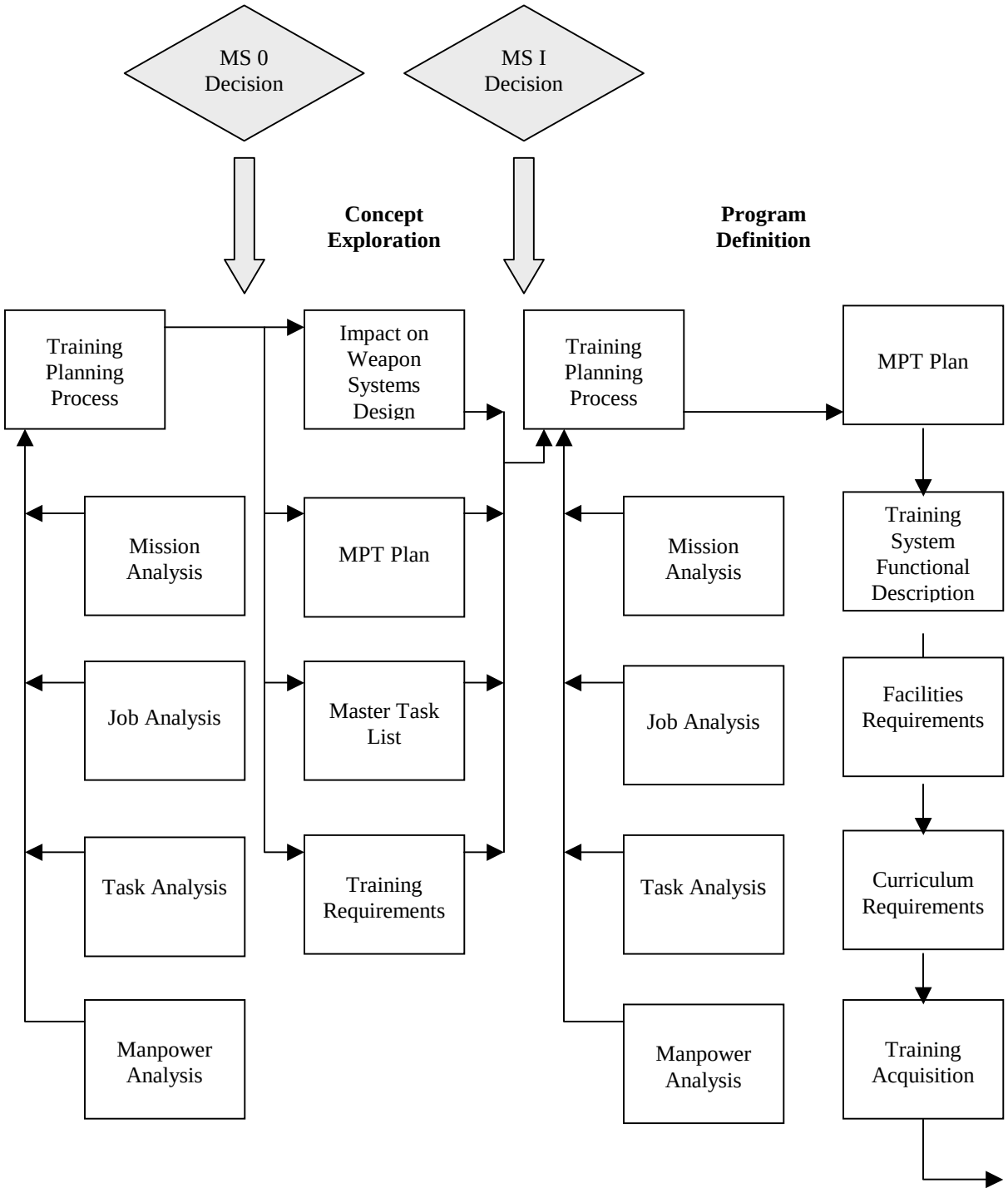

FIGURE 6. **Training roadmap (part 1 of 2 parts).**

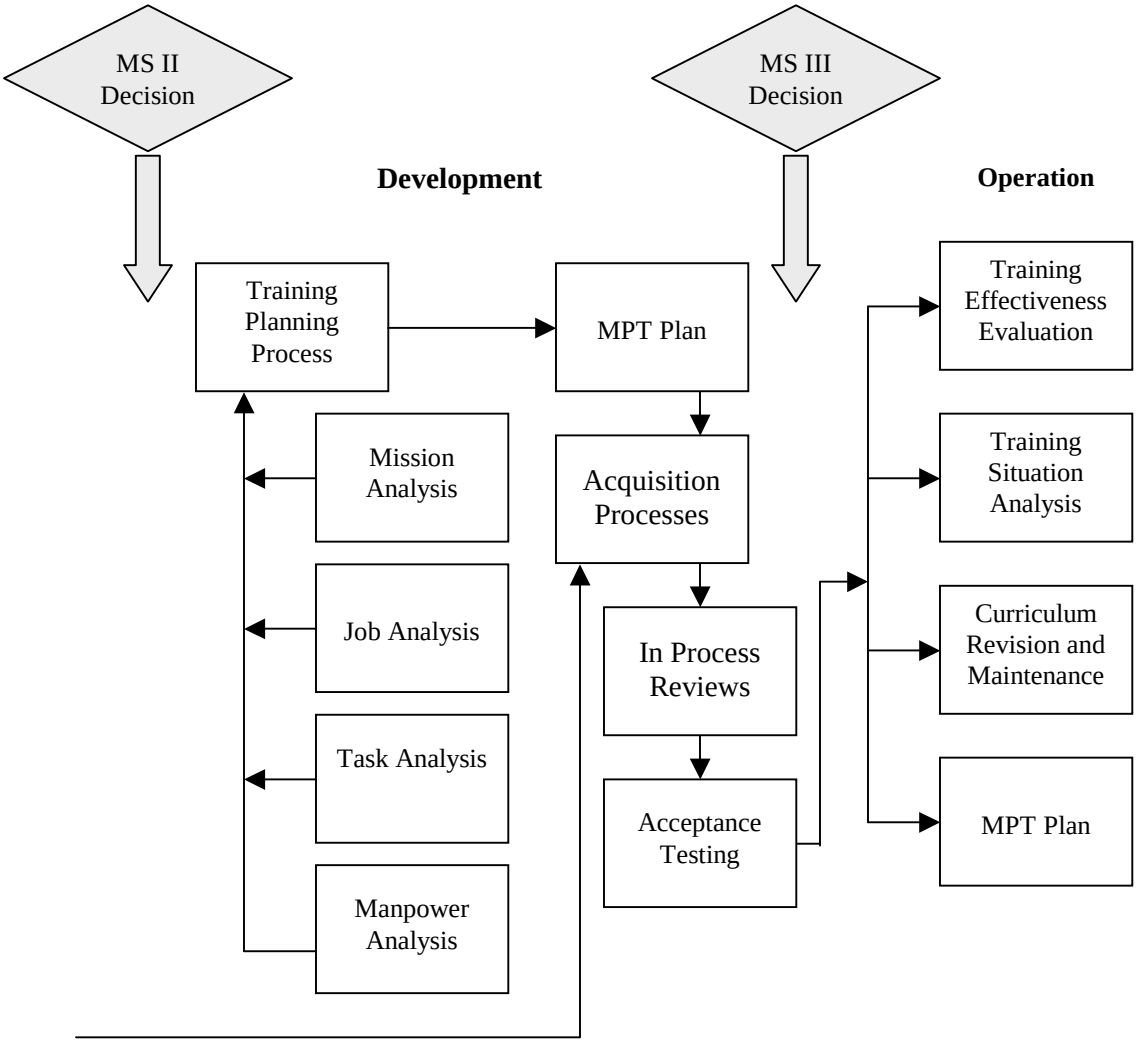

FIGURE 6. **Training roadmap (part 2 of 2 parts).**

5.2 Determine instructional need. The first activity before entering the ISD/SAT process is to determine whether there is an instructional need. The application of a needs assessment and needs analysis makes certain that the critical performance requirements of an organization establish the content of training. Training is not the solution for all performance deficiencies. It is neither efficient nor cost effective to produce training without valid justification. Needs assessment and needs analysis should not be performed in a cursory manner. Cursory analyses drive the design and development processes and consequently influence training programs that must be constantly changed. Measures must be in place and time/resources allotted to conduct a needs assessment and needs analysis. Needs assessment and needs analysis are only successful if supported by all levels of management and command. An audit trail of the process and decisions

made during the process must be maintained. The following are items that should be included in the audit trail:

a. Command directives and tasking documents.
b. A copy of the problem statement.
c. A record of literature search results.
d. Documented possible solutions/corrective actions.
e. A copy of the analysis statement document.

5.2.1 Needs assessment. A needs assessment is the process used to identify and document a gap between the desired and actual unit or individual human performance, as well as determine the cause for the gap. Needs assessment can be reactive in identifying deficiencies between what exists and what is required. Needs assessment can also identify potential deficiencies between current and future requirements as a result of changes in threat, doctrine, organizational structure, leadership development, and materiel. The needs assessment provides a means to identify the gaps between current results and desired results (a comparison of "what is" with "what should be"). Needs assessment is designed to maximize the use of resources in identifying and resolving performance deficiencies. Training should not be developed or revised unless needs assessment determines that training is the means to resolve the deficiencies and that the needs analysis shows there is a requirement. The following paragraphs provide details in the needs assessment process.

5.2.1.1 Identify the performance discrepancy. The beginning point of a needs assessment is a unit or human performance problem. It is necessary to collect, group, and analyze the symptoms of the problem to identify the performance discrepancy. The identification of a problem does not signal the requirement for a training solution, but rather only signals the requirement to continue the needs assessment process. The needs assessment process may include the following:

a. Collect, group, and analyze the triggering circumstances, symptoms, or indicators in the problem identification process. Triggering circumstances or documents may include but are not limited to:

(1) Field commander’s comments.
(2) Unit readiness reports.
(3) Materiel readiness reports.
(4) Individual personnel comments.
(5) Identification of a new or changed threat.
(6) Introduction of a new piece of equipment.
(7) Introduction or restructuring of Air Force Specialty Code (AFSC)/Military Occupational Specialty (MOS)/Navy Enlisted Classification (NEC) code).
(8) Audits, inspections, and evaluations.

(9) Safety reports.
(10) Changes in tactical doctrine.
(11) Lessons learned reports, After-Action Reviews (AARs).

b. It is recommended that an assessment be made to determine the reliability of triggering circumstances, symptoms, or indicators. See Table 3 for factors to consider in assessing the information.

TABLE 3. **Reliability of data**.

ASSESS RELIABILITY OF PERFORMANCE DATA	
FOR THIS TYPE OF INFORMATION	CONSIDER THESE FACTORS WHEN ASSESSING RELIABILITY
Formal Report Examples: a. Training Effectiveness Analysis. b. Team Reports. c. Readiness review reports. d. Other applicable reports/documents.	1. Availability or lack of supporting data. 2. Sample size and use of statistical procedures. 3. Sample size and degree to which assumptions can be made about performance throughout the Services. 4. Unity of view vs. differing opinions. 5. Degree to which report confirms other assessments and actions (e.g., known defects in current training courses, etc.). 6. Degree to which report confirms your hypothesis. 7. Precision (i.e., is report based on the critical task list or other task descriptions, or is it impressionistic?). 8. Logic (i.e., do conclusions represent reasonable assessments of the performance data?). 9. Report experts. (As a rule, look for an expert who is one rank and/or skill level higher than performer.)
Informal Information Examples: a. Phone conversations. b. Department staff reports. c. Discussions with performers at school or one-time performers.	1. Personal knowledge of the person/people providing the information. 2. Level of detail and relationship to critical task lists and other task documentation. 3. Availability or lack of supporting data. 4. Sample size and degree to which assumptions can be made about performance throughout the Services. 5. Unity of view vs. differing opinions. 6. Degree to which report confirms your hypothesis. 7. Degree to which report confirms other assessments and actions (e.g., known defects in current training courses, etc.).

c. A systematic problem-solving approach that can support the accomplishment of needs assessment. Begin by raising questions. The answers to these questions can isolate the essence of the performance discrepancy, and later analysis will suggest acceptable

solutions. An example of questions to be answered during needs assessment are as follows:

(1) What is the real problem?
(2) What is the extent and gravity of this problem (safety/security/environmental)?
(3) What other symptoms are there that indicate the extent of this problem?
(4) Who is deficient?
(5) When is the problem present?
(6) What impact does this problem have on unit performance?
(7) What is the impact on critical task performance?
(8) What is the impact on unit mission?
(9) Is this problem attributable to a skills/knowledge deficiency?
(10) Is this an environmental or motivational problem?
(11) What is the major cause of this problem?
(12) What are contributing causes to this problem?
(13) What are the constraints that hamper problem identification?

d. Document the evidence supporting the possible problem.
e. Determine whether doctrine, training, organization, leadership, materiel, or a combination of these is the cause of the performance problem. The needs assessment process may indicate that the problem is motivational or environmental rather than a lack of knowledge or skill. Proceed with a needs analysis only if the environment and motivation issues prove negative and the problem is one of a knowledge or skills deficiency. Table 4 provides a sampling of the type of characteristics associated with motivational, environmental, and knowledge or skill problems.

TABLE 4. **Types of characteristics**.

MOTIVATIONAL PROBLEM CHARACTERISTICS	ENVIRONMENTAL PROBLEM CHARACTERISTICS	SKILL/KNOWLEDGE DEFICIENCY CHARACTERISTICS
1. Individuals not in appropriate job for their training. 2. Individuals not getting clear/timely feedback on performance. 3. Punishment is a management technique. 4. Lack of clarity as to role in unit mission. 5. Good performance is punished. 6. Non-performance is rewarded. 7. Reward system is minimal or no reward for quality performance. 8. Tasks are distasteful.	1. New equipment, system, or process present. 2. Required support equipment broken or missing from unit. 3. Work facilities inadequate. 4. Barriers to performance present. 5. Personnel shortages. 6. Work flow unclear. 7. Supply and demand difficulties exist. 8. Frequent supervisory changes.	1. Individuals cannot perform a task correctly when observed. 2. Practice of tasks is infrequent or unrealistic. 3. Task requires the application of concepts, rules, and principles. 4. Task is new to job incumbents. 5. There is a history of inadequate training in the unit or the school. 6. Performance is complex and must be performed without using job aids. 7. Performance is guided, but the guides are poorly written. 8. Performance is poorly defined or described.

f. Table 5 shows some possible solutions to motivational and environmental problems, deficiencies in skills and knowledge, and flawed incentives and policies.

TABLE 5. **Possible solutions**.

CAUSE	SOLUTIONS	
Weak motivation	• Information. • Job aids.	• Coaching. • Mentoring.
Faulty environment	• Job redesign. • New tools.	• Technology.
Absence of skill/knowledge	• Training. • Information. • Job aid.	• Coaching. • Mentoring.
Flawed incentives/policies	• New policies. • Management development.	• Supervisory training.

g. If the conclusion of the problem solving points to a training deficiency, proceed with the training program needs assessment.

5.2.1.2 Training program needs assessment. Develop or revise existing training programs only when revisions are necessary. Some reasons for new development or revisions to existing training programs include the following:

a. Restructuring of AFSC/MOS/NEC. This situation has implications for the entire instructional development process beginning with the analysis of the restructured AFSC/MOS/NEC.
b. Failure of students to meet objectives. Ambiguity in tests, tests that don't track with objectives, or inadequate instruction can be contributing factors to students failing to meet objectives. Inadequate student performance requires a careful analysis to find the cause. Revising training programs does not always require adding training.
c. Graduates unable to perform the job after training. If external evaluation indicates that graduates are not able to perform the job for which they were trained, revisions may be necessary. The evaluation may indicate that the nature of the job is different from the original job analysis. After identifying a deficiency exists, a needs assessment should be conducted to determine if training is the solution. For example, if the graduate was trained for one job but assigned to another job, the training program is not responsible for inadequate performance.
d. Need for more efficient training. Revision may be required when evaluations of training programs or changes in training requirements suggest a need for making training more efficient in terms of time, money, or other resources. It is the responsibility of the training developer and managers to always look for ways to improve the effectiveness and efficiency of training. Revision of a course is not recommended if there is a more efficient means to improve the training program.

5.2.1.3 Prepare the problem statement. Prepare a detailed description of the discrepancy between the desired and actual mission/job performance. This description gives an exact statement of the deficiency. Make the statement as specific as possible. State the deficiency in terms of the standard that has not been met instead of attributing a cause to the deficiency. For example, "individuals don't install the Radio Frequency (RF) antenna correctly" rather than "individuals don't know how to install the RF antenna correctly." The refined problem statement should answer:

a. Who are the personnel that are performing a task inadequately?
b. What is the exact performance problem?
c. When and where is the task performed incorrectly?

5.2.1.4 Needs assessment output. The output of a needs assessment is a precise definition of performance discrepancies in terms of measurable, observable symptoms which substantiate a

problem. After identifying the discrepancies, the developer can devise appropriate solutions. Training is an appropriate solution, when the performance discrepancy is attributable to a knowledge and/or skill deficiency. Training alone cannot correct environmental or motivational problems. However, additional training may be needed to support an environmental or motivational fix. All information resulting from the needs assessment must be passed to the responsible agency.

5.2.2 Needs analysis. Needs analysis follows needs assessment when it is determined that there is a training problem. The needs analysis is the process used to verify an identified training problem, identify and analyze possible solution(s), and develop the recommended solution(s) to the problem. Needs analysis provides training developers with a complete breakdown of the training-related deficiencies, translates the deficiencies into requirements for observable change, and determines what aspect of training is a viable solution to the performance problem. The needs analysis determines if the solution justifies further training development work. A needs analysis does not always point to the requirement for performing the entire ISD/SAT process.

5.2.2.1 Verify the training problem. The needs analysis confirms or rejects the hypothesis that a change in training can correct or relieve the deficiency.

5.2.2.2 Determine solutions. The training developer will determine all possible training solutions or corrective actions to be taken to solve or alleviate the problem. The problem may be one that suggests multiple training answers; therefore the analysis must be conducted in such a way that each recommendation stands alone. Forward all solutions to responsible agencies. The following are some steps to follow when developing solutions:

a. Take the following steps to develop tentative solutions:

(1) Determine the affected student target population.
(2) Identify all affected collective and individual tasks.
(3) Identify all affected training data products.
(4) Identify all affected training programs and courses.
(5) List all possible training solutions.
(6) Estimate resource requirements and develop milestones for each solution.
(7) Identify the impact of the solution on current training development plans.

b. Take the following steps to develop recommended solution:

(1) Evaluate the tentative solutions.
(2) Select the best solution and prepare a final needs analysis recommendation.
(3) Obtain recommendation approval.
(4) Forward recommended solution to the appropriate agency for action.

5.2.3 Prepare needs analysis statement. The needs analysis statement should contain a detailed description of the problem, the selected solution, rationale for the solution, and the training development requirement.

5.2.4 Input into training development planning and process. After determining that a particular training program or product requires revision, the next step is to identify which parts of the program will be affected. As in other processes, the practical issues of time, money, and manpower can influence what to revise. Perform the following:

a. Develop the training development revision plan. Clearly identify the training program and product problems and specify the planned actions needed to eliminate or alleviate the problem. The revision plan should include clear statements of the problem, and the time and resources required to accomplish the revisions. Additionally, the plan should indicate the effect revisions would have on other ongoing instructional activities. Finally, the plan must indicate the type of improvements that are recommended.
b. Make changes to applicable phases. Once the revision plan is finalized the revisions must be made. One or more ISD/SAT phases may be affected. Revision to an early phase such as analysis will more than likely require subsequent revisions in the design, development, and implementation phases.

5.2.5 Needs analysis output. The output of the needs analysis is an approved needs analysis statement. The needs analysis is complete with the preparation of a training development requirement.

5.3 Determine instructional system concept. When planning the instructional system concept, make a preliminary estimate of the requirements and constraints to be considered in fielding the total instructional system. Requirements for the instructional system include the following:

a. Scope of the instructional problem.
b. Location(s) of the instruction.
c. Anticipated student load.
d. Alternative instructional strategies, methods, and media (predictions of effectiveness).
e. Support; providing for and maintaining all parts of the system.
f. Facilities requirements.
g. Evaluation; assessment of how well the system and the students perform.
h. Quality improvement; process and product compliance with approved plans, procedures, and processes.
i. Funding requirements (non-recurring and life-cycle).

5.4 Develop an ISD/SAT management plan. Prepare a plan of action and milestones to meet the training requirement. Identify the goals and constraints of the specific ISD/SAT project.

5.5 Develop an ISD/SAT evaluation plan. Evaluation should be integrated throughout each activity of the ISD/SAT process. One of the top priorities of every manager is to develop an ISD/SAT evaluation plan to ensure that the instructional development process is of high quality. Quality is a continuous process when developing a new instructional system or revising an existing system. The concern for quality continues throughout each phase of the development process. Evaluating or assessing the quality of the ISD/SAT evaluation plan is necessary to establish what and how you are to evaluate during the instructional development process. The plan, which is the benchmark for quality, ensures that the ISD/SAT process results in a quality instructional system.

5.5.1 What is in the plan? The ISD/SAT evaluation plan includes information sufficient to ensure that ISD/SAT results in quality process and products. The plan may include, but is not limited to, the following information:

a. Identification of responsibilities including tasking.
b. Scope and purpose of the evaluation.
c. How and when the evaluation activities are to be accomplished.
d. Documentation and report requirements.

6. ISD/SAT ANALYSIS PROCESS

6.1 General. When a needs assessment has indicated a training requirement, the ISD/SAT project planning has been completed, and the instructional system concept is approved, it is time to enter the analysis phase of instructional development. During this phase, instructional developers conduct various forms of analyses such as training situation, occupational, job, mission, and task analyses. These analyses continue through the selection of training tasks. The nature and scope of each ISD/SAT project determines which of the various analyses need to be conducted. For example, revising an existing course to cover a modification to existing equipment would not require another job, learning, or target audience analysis. However, introducing a major new weapon system that effects changes in the occupational specialty would require complete analysis and major revision to current training. An ISD/SAT model with the analysis phase highlighted is presented in Figure 7 to help visualize the ISD/SAT process.

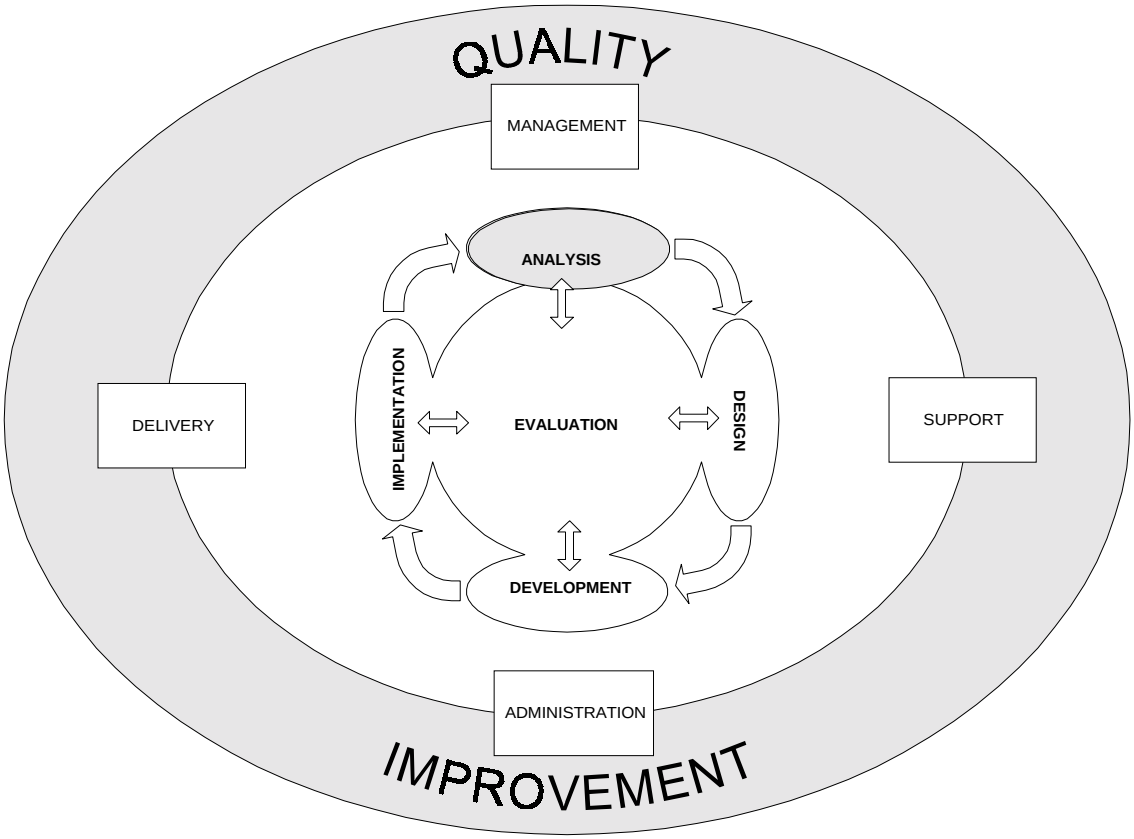

FIGURE 7. **ISD/SAT analysis phase.**

6.1.1 Overview. Training program development begins when it is determined that no existing training program adequately trains individuals to perform a particular job or mission. A needs assessment should already have been conducted to determine if there is a problem for which instruction is the appropriate solution. If the needs assessment identified an instructional requirement, ISD/SAT would usually begin at the analysis phase. Job or mission analysis is the process of examining a specific job or mission and identifying all the tasks required to accomplish the job or mission. Information must be collected and analyzed to establish exactly what constitutes, or what will constitute, adequate on-the-job performance. The data collected during the analysis process forms the foundation for all training development including design, development, implementation, and evaluation of training. If the task analysis data is not valid and accurate, the resulting training program will fail to provide personnel able to perform their duties at an acceptable level, regardless of how well the subsequent steps of the ISD/SAT process are carried out. The final output of this analysis is a list of tasks to be trained in order to produce personnel able to perform their duties at an acceptable level. However, in some cases where the mission/job/task analyses have already been completed, you may be able to enter directly into the design phase of ISD/SAT. Figure 8 depicts the ISD/SAT analysis phase process.

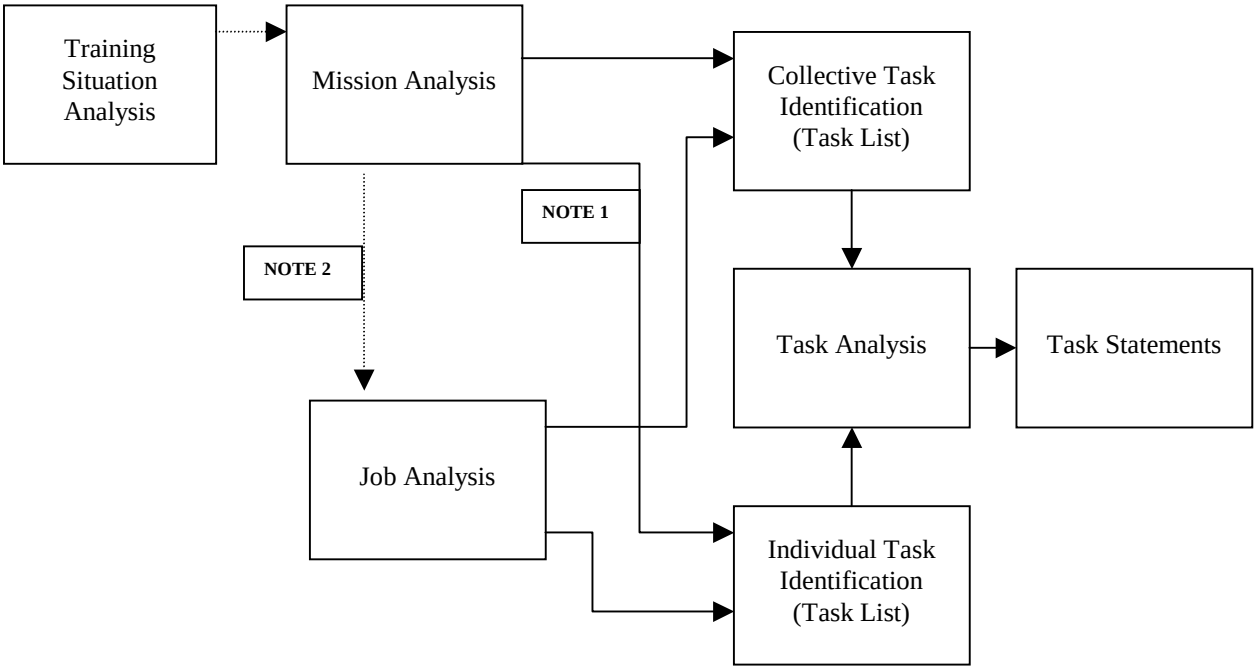

FIGURE 8. **ISD/SAT analysis phase process**.

6.1.2 Who is responsible? Program managers are responsible for ensuring that the necessary analyses are conducted. The responsibility is to ensure that the data needed for further analysis and course design work have been obtained. In most cases, other individuals such as instructional developers, Subject Matter Experts (SMEs), or system analysts should conduct the actual analyses or at least provide technical assistance. Assistance may be needed from one or more of the following:

a. Occupational analysis personnel.
b. System engineers.
c. Educational specialists.
d. Contractors.
e. Standing committees (e.g., Commission Education Committee, etc.).

6.1.3 Scope. The scope of the analysis phase will depend on the application, depth, and nature of the project. The application may be for a mission, job, or occupation training requirement, or an educational requirement. The depth could be as simple as a modification to

an existing training program, or as complex as a training requirement to support a new major weapons system. The nature of the project could include a joint Service mission training requirement and an educational requirement. Training situation, occupational, educational, and mission analyses consist of the following:

a. The Training Situation Analysis (TSA) is a process of identifying a requirement to develop or revise an instructional program.
b. The educational analysis is a process of reviewing the educational requirements, developing educational goals, and developing statements for achieving the goals.
c. The occupational analysis is a process of identifying tasks that are closely related and grouped under an occupational specialty.
d. The mission analysis is a process of reviewing mission requirements, and developing a mission statement, mission segments, collective task statements, and arranging the segments and tasks in a hierarchical relationship.
e. The job analysis identifies the duties and tasks that comprise each job, which may define an occupational area.

6.2 Training situation analysis. A TSA is the method used to identify whether there is a need to develop or revise an instructional program. The following paragraphs provide guidance for conducting a TSA.

6.2.1 Determine analysis scope. Develop purpose and goals for the analysis based on the operational environment. The analyst should ensure that each goal of the analysis is associated with the actual performance of a mission/job.

6.2.2 Identify data requirements. Study the perceived instructional problem to determine what type of data should be collected in order to perform a specific TSA. In order to accomplish this, the analyst should gather as much background information as possible. Some of the information needed during the preliminary analysis is listed below:

a. Specific source of the problem/deficiency (e.g., instructor observations, school/course manager's observations, supervisor’s report on job performance of graduates, student performance results, new weapon system, etc.).
b. Specific symptoms of the problem/deficiency to include the actual performance and desired performance requirement. Problems/deficiencies may be caused by:

    (1) The addition of a new tactical mission.
    (2) The introduction of new or modified equipment to the operational environment.
    (3) A requirement to improve the skills training in areas where course graduates show insufficient proficiency.
    (4) A desire to enhance the training in terms of effectiveness and/or cost.

c. JMETL.
d. SMETL.
e. Network centric warfare doctrine.
f. Previously performed studies or analyses related to the problem/deficiency.
g. Location(s) associated with the training.
h. Problems previously encountered and technical difficulties experienced by other analysts who have researched similar problems.
i. Availability of data, literature, and personnel that could be useful in analyzing the problem/deficiency.

6.2.3 Select the data collection method. Identify the sources of data required for the TSA and the method of collecting data from each source. See Appendix B for examples of data collection methods.

6.2.4 Collect and analyze data. Collect data on the existing situation to include the reason for conducting the analysis, and the training program's organization, mission, instructional staff, student population, course, training equipment, and facilities. Assemble the data into a format usable for the analysis process.

6.2.4.1 Instructional needs data. Collect the documents that identified the perceived instructional problem.

6.2.4.2 Training program organization and user commands. Develop an organization chart of all commands involved in the occupational field under study, from the Chiefs of Staff level to the subject training unit. Develop an organization chart of the departments, base commands, supporting commands, and supporting agencies involved in directing or supporting training roles. Describe the major roles and responsibilities of each identified command, agency, or individual. Specify the commands that use the instructional materials and the type of instructional materials used by each command. Secure a commitment from the using command to provide training management oversight funding for the life of the system including annual reviews. In organizational responsibility charts show Training Managers as operating at the major command level.

6.2.4.3 Course data. Compile data concerning course type, course category, or segment in the existing training program. Describe each segment and the methods and media currently used. Specify the performance measures used to assess student success in each segment. Consider the entire training pipeline and study its overall goals. Consider the segment being analyzed in terms of its contribution to the individual's entire training pipeline. The goals, content, and length of each segment should be considered in terms of its contribution to the total training pipeline, as follows:

a. Develop a summary of the major goals, content, length, and integration of the segments.

b. Describe the academic, synthetic, operational equipment, and instructional units of each segment.
c. Describe the performance measurement methods and applications.

6.2.4.4 Identify student population. Develop descriptive data about the student population characteristics in each course category, as this data may pertain to new training system recommendations. Effective course design, scheduling, and planning depend on accurate descriptions of student population characteristics that include quantity, prerequisite knowledge and skills, aptitudes, mental categories, and reading proficiency. Document the number of current and projected classes per year based on manpower and personnel studies. Also, study the student personnel pipeline and attrition rates to assess the effect the student population characteristics have on the number of students trained. A comparison of the student's qualitative characteristics (i.e., aptitude, mental category) to the course entry level requirements should be made. Document the following information relating to student population:

a. The number of current and projected classes per year.
b. The current and projected class size and the range of anticipated size.
c. The student entry level requirements and noted exceptions.
d. The pipeline source(s).
e. The attrition rates.
f. Any readiness deficiencies.

6.2.4.5 Training equipment, operational equipment, and facilities. Develop descriptive data about the equipment, media, and facilities that provide useful support or could feasibly provide support to the course categories described previously, and should include:

a. Trainer information:

    (1) Each trainer's quantity, location, and type.
    (2) Each trainer's capabilities and deficiencies.
    (3) Any planned modifications and procurement.

b. The operational equipment, include the type, quantity, availability, configuration, and utilization rate of each piece of operational equipment for training purposes.
c. The training ranges by describing each training range's type, capability, utilization, and planned modifications.
d. Current instructional media information:

    (1) Types.
    (2) Quantity.
    (3) Subject content.
    (4) Capability.

(5) Adequacy in terms of curriculum requirements.
(6) Reliability.
(7) Maintainability.
(8) Configuration.
(9) Authoring language.
(10) Courseware development/authoring tools.
(11) Version.

e. The media support capabilities by describing the facilities and maintenance capabilities in terms of specific media category types or training equipment maintained.
f. The command support capabilities and facilities for photographic, printing, illustration, and graphic production. Including command support for coordination requirements, timeliness, and funding requirements.
g. The training facilities by describing the type, size, and number of classrooms, learning centers, briefing rooms, etc.
h. Trainee support facilities (e.g., housing, messing, recreational, etc.).
i. Identify ADL infrastructure requirements. (See MIL-HDBK-29612-5).

6.2.4.6 Identify current training support personnel (e.g., instructors, support staff, etc.). Develop a description of the instructional staff and changes in requirements that are necessary to support training. Assess the organization of the instructional staff and verify the instructor's qualifications, certification, roles, and responsibilities. Assess instructor workload, authorized and assigned manpower levels, and turnover rates. Assess practices to standardize and improve instructor quality. Document the following:

a. Instructional staff organization.
b. Instructor roles and responsibilities.
c. Instructor qualifications, including instructor operational experience requirements and instructor training requirements.
d. Instructor workload to include instructional duties, collateral duties, and operational requirements.
e. Instructor turnover rate.
f. Current policies for instructor certification, standardization, and improvement.
g. Instructor support staff roles.
h. Technical support staff certification.

6.2.5 Analyze the data. Analyze the collected data to determine training deficiencies and needs. Determine whether the perceived training need can be resolved by the instructional community, or is caused by something outside of the community.

6.2.5.1 Verify instructional need. Study the collected data to determine the existence of instructional needs and non-instructional issues. Assess inconsistencies between the operational

mission/job and the manner in which the mission/job is trained. After determining that there is an instructional need, determine whether the instructional needs are caused by the curriculum design, the student population, the instructors' qualifications, a new instructional need, or another instructional related cause. The following may help in verifying an instructional need:

a. Identify the extent and gravity of the problem. Obtain information from field commanders about the extent (widespread among a number of units or isolated) seriousness, safety, or security of problem and its impact on mission capabilities.
b. Identify the impact on individual and unit performance. If there are no mission consequences, there may be no need to pursue the matter further.
c. Assess reliability of the information. See Table 6 for factors to consider when assessing both formal and informal performance reports.
d. Determine statistical validity of the training requirement to verify whether events are chance occurrences.

TABLE 6. **Assess reliability of performance data**.

FOR THIS TYPE OF INFORMATION	CONSIDER THESE FACTORS WHEN ASSESSING RELIABILITY
Formal Report Examples: • Training effectiveness evaluations. • Lesson learned reports.	• Availability or lack of supporting data. • Sample size and use of statistical procedures. • Degree to which assumptions can be made about performance throughout the Services. • Unity of view vs. differing opinions. • Degree to which report confirms other assessments and actions (e.g., known defects in current training courses, etc.). • Precision. Is report based on task descriptions, or is it impressionistic? • Logic. Do conclusions represent reasonable assessments of the performance data? • Report experts. Were they the right experts? As a rule, look for an expert who is one rank and/or skill level higher than that of the performers.
Informal Information Examples: • Phone conversations. • Discussions with performers at school or first-time performers. • Discussions with performers in the field. • After action reviews.	• Personal knowledge of the personnel providing the information. • Level of detail and relationship to task documentation. The more explicit the information, the more likely it is to be valid. • Availability or lack of support data. • Sample size and degree to which assumptions can be made about performance throughout the Services. • Unity of view vs. differing opinions. • Degree to which report confirms your hypothesis. • Degree to which report confirms other assessments and actions (e.g., known defects in current training courses, etc.).

e. Identify the major causes of the performance deficiency. Causes for unacceptable performance are usually deficiencies in doctrine, training, leadership, organizational, and/or materiel (equipment) deficiencies. Table 7 lists indicators of problem causes that may be related to the performance deficiency. Review your evidence in light of these indicators.

TABLE 7. **Indicators of problem causes**.

INDICATOR	CAUSE	POSSIBLE SOLUTION
• Practice is infrequent or unrealistic. • Performance is complex and has no job aid. • Task/equipment is new. • Individuals do not possess required knowledge to perform task.	Training deficiency	• Training. • Information. • Job aid. • Coaching. • Mentoring.
• Individuals not in appropriate job for their training. • Individuals not getting clear/timely feedback on performance. • Lack of clarity on role/job in unit. • Reward system is inadequate. • Tasks are distasteful.	Leadership deficiency	• Information. • Leader training in coaching, mentoring.
• Work facilities inadequate. • Barriers to performance present. • Personnel shortages. • Supply and demand difficulties. • Organizational makeup not adequate for mission requirements. • Frequent leader changes.	Organizational deficiency	• Refer appropriate information to the unit chain of command.
• Individuals perform as expected but mission still not achieved. • Equipment constantly broken.	Materiel deficiency	• Refer appropriate information to cognizant personnel.

f. Training can only solve knowledge and skill deficiencies. Problems relating to environmental or motivational factors indicate a performance deficiency in one or more of the other causal areas and cannot be solved simply by training.

g. Review any previous test results and course evaluations. Do the LOs, as stated, reflect the actual job performance requirements? Can the individuals perform the objectives to the stated standard at the end of training? Look for information suggesting that the whole course may have some problems, as opposed to a particular session or instructor or student(s) having a problem. See Table 8 for suggestions on how to evaluate certain common types of evaluation information. Check for information indicating that tests have been validated (i.e., that students who pass tests can perform effectively and those who do not pass cannot perform). If no data exists, focus the rest of the course review on ways to make the course more efficient and more reflective of anticipated individual performance in the future.

TABLE 8. **Reviewing evaluation information about school courses**.

TYPE OF EVALUATION INFORMATION	CONSIDERATIONS
Student attrition rates	• Identify trends. Attrition rates staying about the same? Improving? Worsening? • Identify causes. Where rates are high, administrative reasons may cause the dropout rate such as failing the physical fitness test.
Special training times	• Ensure the student evaluation plan includes remediation details. • Identify remedial training in current and previous courses and its extent. Such remediation may be taking place without overall course length being extended (for example in the evenings). • Review the total training day. • Review the plan of instruction for massed training right before a test (could indicate insufficient previous training or poor training design).
High failure rates for certain tests	• Review test data. • Do not change the standard unless it is clearly inappropriate; look for the possibility that certain tests are causing problems. Poorly written tests may cause failures. If the test is valid, then check the training design and presentation.
Student critique sheets	• Identify trends between classes and over a period of time. • Keep the perspective of the students in mind. For many courses, they may lack experience to reach a balanced judgment. • For leadership courses, critiques will often reflect experience. • Be alert for a grouping of complaints around particular tests, instructors, or training sessions. • Pay attention to students saying they "still do not understand." Even if they do in fact understand, such expressions indicate a lack of confidence, which in itself may cripple performance.

h. Identify how well individuals should be performing at the end of training and on the job. Task analysis and course design documents provide the original intent of the course (as stated in objectives). Evaluate that intent against current individual performance at the end of training and in the field. Failure to perform this step often leads to making changes that do more harm than good. Consider holding a review with a team of SMEs, training developers, and instructional system specialists. As a rule, select individuals who have recent field experience and who are at least one grade and skill level above the grade/skill level being taught in the course.

i. Identify strengths and weaknesses of course tests, including hands-on tests. Vital factors to look for include:

(1) Terminal LOs that are tested.
(2) Use of hands-on performance tests.
(3) Use of criterion-referenced tests.
(4) Written tests, where used, are valid (see Table 9).
(5) Whether tests realistically measure performance of LOs.
(6) Tests allow use of job aids when they are used on the job.
(7) Decision to use trainers in tests is for the sake of costs, safety, or enhanced realism.
(8) Test items with high failure rates are reviewed.

TABLE 9. **Using written tests**.

QUESTIONS ABOUT WRITTEN TESTS	CONSIDERATIONS
Is the performance that is being measured paper and pencil performance?	When the performance consists of filling in forms, correcting memos, preparing letters for commanding officer signature and the like; paper tests are the obvious choice.
Is the test being used to indirectly measure "thinking" behavior?	Often, thinking behavior is best measured using paper tests. For example, problems, which are primarily mathematical in nature often, are easily and accurately evaluated with paper tests. Examples include: ammunition expended at different rates of fire, distances that can be traveled given current fuel levels, etc. Also, memorized performance can be measured using paper (e.g., specifying from recall the five steps of medical assistance on the battlefield, etc.). High level knowledge test examples. Cognitive process, problem solving, mission planning.
Is written testing being substituted as a less costly alternative to other forms of testing?	Often, costs drive the decision to use paper tests. When this is the case, look to see if the performance is tested elsewhere in the course using more realistic evaluation devices. Or, look to see if acceptable performance of a task can be inferred from the hands-on tests of other tasks. For example, in leadership courses, case studies are often used to evaluate an individual's ability to respond to a variety of different situations, combat or otherwise.
Does the written test measure anything useful?	Multiple choice tests can be used for measuring the knowledge of a student prior to entering a course, reinforcement of content knowledge, placement, post-testing etc. As a rule, multiple choice tests can accurately measure "recognition" levels of performance while using them to measure "recall" and "hands-on" performance always involves an inferential leap.

6.2.5.2 Assess non-instructional issues. Assess the effect of non-instructional issues on the training situation. Two types of non-instructional issues that could impact the situation are:

a. A material/equipment issue that is caused by logistical or supply problems. Material or equipment issues include an inadequate quantity of student supplies (i.e., workbooks, trainee guides, and technical manuals) or equipment problems such as inadequate availability of simulators. Determine whether the non-availability of simulator hours is caused by class scheduling problems, an inadequate number of simulators for the student load, poor reliability, or maintenance problems.
b. Assess issues that are created by the user or the community such as:

(1) Determine whether personnel policies are affecting the instructor pool or the student population, as follows:

(a) Study the instructor turnover rates.
(b) Assess the student population's basic skills, aptitudes, mental categories, and attitudes.
(c) Assess other personnel policies to determine their effect on the instructional situation.

(2) Determine whether facility policies or practices are affecting the training situation as follows:

(a) Assess whether the instructional facilities (i.e., ranges, classrooms, and simulators) are dedicated to the course.
(b) Assess whether the course schedule is arranged to suit other base operations, to the detriment of the instructional situation.

(3) Determine whether material or equipment issues are affecting the instructional situation as follows:

(a) Assess whether the instructional facilities (i.e., classrooms, ranges, and trainers) are physically adequate for instructional purposes.
(b) Assess whether instructional materials were available on time and in adequate supply.
(c) Assess whether the trainers were available. Document the reasons for non-availability (i.e., poor reliability or maintainability).

6.2.5.3 Identify the impact. Determine the impact to the instructional situation as follows:

a. Assess course requirements or deficiencies. Assess the existing training system to identify the causes of a perceived training need, or to assess the impact of a new training requirement on an existing training system. Use the results of this assessment to determine significant training problems, concerns, or needs. Typically, an analyst uses the information determined here to develop and assess alternative solutions. The

procedures described below are designed to evaluate courses of instruction conducted in a formal school setting. However, the analyst can use many of these assessment procedures for other training. The assessment procedures are not all-inclusive. Therefore, the analyst is not restricted to the use of just these procedures. The procedures apply to the following areas:

(1) Philosophy and goals. Assess correspondence of LOs to course mission/purpose.
(2) Course. Assess the following:

(a) Task to operational equipment correspondence.
(b) Test item to LO correspondence.
(c) Course sequence.
(d) Number of instructors and training support staff required.
(e) Instructional facilities required.
(f) Student mastery of LOs.
(g) Student motivation and course acceptance.
(h) Whether students meet course prerequisites.
(i) Learning objective to job task.

(3) Training delivery system. Assess appropriateness of instructional media delivery system.
(4) Operational equipment. Assess requirements for operational equipment.
(5) Trainers. Assess the following:

(a) Trainer effectiveness.
(b) Trainer utilization.
(c) Correspondence of the trainer to its functional characteristics requirements.
(d) Correspondence of the trainer scenarios to the job task.

b. Assess the sequence of the course LOs. Perform this assessment to determine whether the course of instruction was designed in a sequence that promotes learning. A course of instruction should be constructed to teach enabling knowledge and skills, and then build on these enabling skills by introducing increasingly complex knowledge and skills. The analyst can determine whether a course of instruction is following this type of sequence by studying the course LOs.
c. Determine statistical validity of the trainer impact on the instructional situation.
d. Apply inferential statistical analyses to determine whether results are due to chance.

6.2.6 Identify solutions and alternatives. There may be significant training problems, concerns, or needs discovered that must be documented. The documentation should include a discussion of the problem and the procedures involved in the problem. Develop at least two

possible solutions to the problem. Evaluate each solution, determine the best possible answer to the problem, and determine how to implement the solution.

6.3 Educational requirements analysis. This is a process of reviewing the documented educational requirements, developing educational goals and related task statements, and determining how to achieve the goals. The analysis process for identifying educational requirements is the same as for task analysis (See 6.7 and Table 18 below).

6.4 Occupational analysis. This is a process of surveying personnel assigned to an occupational specialty to identify tasks they are currently performing to determine the adequacy of training for the occupational specialty. An occupational analysis may also be conducted to identify new tasks that should be assigned and trained in an occupational specialty. The analysis process for identifying occupational requirements is the same as for task analysis (See 6.7 and Table 18 below).

6.5 Mission analysis. Mission analysis is the examining of JMETL/SMETL, specific organization or unit mission or doctrinal directives, and identifying all the mission and collective tasks performed by unit personnel. Examples of source documents containing mission statements are the Table of Organization and Equipment (TOE), and Required Operational Capabilities/Projected Operational Environment (ROC/POE). Instructional developers should refer to specific Service pamphlets, handbooks, and/or guidance documents for additional mission analysis support information.

6.5.1 When to conduct mission analysis. Mission analysis should be conducted when one or more of the following indicate that major changes have occurred in the structure or content of the tasks required of a particular unit. Major changes may include:

a. The creation of a new type unit.
b. Significant changes in the operational concept and employment doctrine of a unit.
c. Significant changes in the mission or capabilities of an existing unit.

6.5.2 When to conduct mission analysis updates. Mission analysis updates should be performed when one or more of the following occur:

a. Changes in threat.
b. Changes in weapon system or other military hardware.
c. Changes in personnel or equipment requirements within an existing unit.
d. The publication of a new field manual, and the requirement to produce a new training manual.

6.5.3 Mission analysis cost constraints. Cost constraints will normally prohibit performing a mission analysis on each individual unit, therefore, mission analysis should be conducted on a representative unit.

6.5.4 Identify organization level responsible for mission. The organizational level is an important factor among the mission, mission segment, and collective task relationships. A convenient method for documenting is through the use of diagrams.

6.5.4.1 Command structure diagram. A structure diagram makes it is easier to see the chain of command relationships among the parent organization, the unit subject to the mission analysis, and the next lower echelons within the command. Figure 9 provides an example of a command structure diagram.

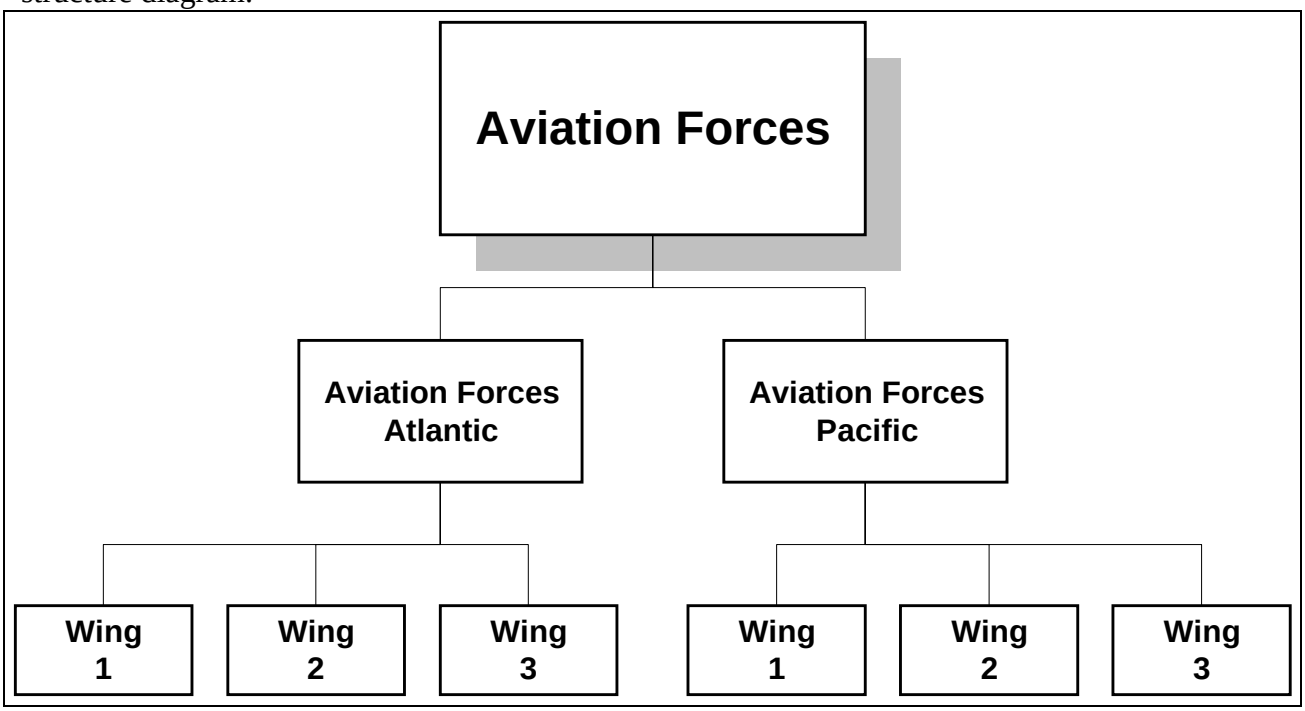

FIGURE 9. **Sample command structure diagram**.

6.5.4.2 Organizational diagram. Once the command structure diagram is complete, develop an organizational diagram for the unit to be analyzed. This type of diagram is useful for analyzing task organized unit missions. Once the organizational diagram is developed, the instructional analyst can determine which echelons of the unit to analyze in-depth. Start with identifying the missions of the unit's highest echelon.

6.5.5 Mission identification. A mission is defined as a series of related tasks that comprise the major required capabilities imposed on a unit by its parent organization. Mission analysis usually begins with the highest echelon in the organization or the supported unit. These missions are the basis for the analysis of the lower-echelon missions. In other words, the training

developer should know the missions of the battalion before identifying the mission of its subordinate companies. When the training developers complete the mission analysis, they generate a great deal of information about the unit's missions and capabilities at each echelon. This information may provide a basis for recommending changes to the unit's mission statements and capabilities. Identify both stated and implied missions for the unit as follows:

a. Identify the JMETLs and SMETLs that are related to the mission.
b. Identify concept documents related to the mission.
c. Identify the stated missions by using the TOE, ROC/POE, doctrine, or other mission related documents. Battalion, company-level unit, squadrons, ships and other activity TOEs, ROCs/POEs typically provide the training developer with a concise mission statement and a list of unit capabilities.
d. Identify implied missions. Implied missions are those missions not stated in the TOE, ROC/POE or doctrine, but are normally performed by the unit. An example of an implied mission is "Conduct a Passage of Lines" Although "Conduct a Passage of Lines." is not defined as a mission in most unit's doctrine, the related collective tasks that comprise "Conduct a Passage of Lines." must be performed as part of many units' normal battlefield activities.
e. Describe the missions in a standard format. The wording of the statement consists of an action verb, an object, and a possible qualifier (optional), they are defined as follows:

    (1) Action verb - "Conduct…". An action verb is that portion of a mission statement that denotes a physical or mental process performed by a unit. See Table 13 for a standard verb list.
    (2) Object - "…a passage of lines.". An object is that portion of a mission statement that denotes the object toward or upon which an action is performed.
    (3) Qualifier. A qualifier is that portion of a mission statement that describes the intended action in greater detail than expressed by the action verb and object alone.

f. Develop mission matrices. Once the missions of the highest echelon or supported unit are identified, analyze those missions to derive missions for echelons at the next lower level. A method for doing this is to display the relationship between the missions performed at different echelons using matrices or diagrams as in Table 10.

TABLE 10. **Squadron mission matrix**.

SQUADRON	TROOP	TANK CO	HHT	HOW BTRY
Defend BP	Defend BP Screen	Defend BP Hasty Attack	Provide CSS Provide C&C	Provide Fire Support
Raid	Hasty Attack Area Recon Screen Route Recon MTC Zone Recon	Hasty Attack	Provide CSS Provide C&C	Provide Fire Support
Breakout from Encirclement	Hasty Attack MTC Defend BP Screen Delay	Hasty Attack Defend BP	Provide CSS Provide C&C	Provide Fire Support
Battle Handover/ Passage of lines	BHO/Passage Defend BP Screen Tactical RM Hasty Attack	BHO/Passage Defend BP Tactical RM Hasty Attack	Provide CSS Provide C&C Tactical RM BHO/Passage	Provide Fire Support Tactical RM BHO/Passage

(1) The purpose of the matrix is to identify what missions next-lower echelons are performing during each of the higher echelon's missions. For example, if the Armored Cavalry Regiment (ACR) squadron is performing the Mission ("Conduct a Hasty Attack"), the matrix would show what missions the next-lower echelons (the troop, tank company, headquarters and headquarters troop, and howitzer battery) may be performing to support the squadron's attack. (One word is sufficient to describe the mission when depicting it in a diagram). Table 11 is an excerpt from a squadron mission matrix.

TABLE 11. **Squadron mission matrix excerpt**.

SQUADRON	TROOP	TANK CO	HHT	HOW BTRY
Hasty Attack	Hasty Attack Zone Recon Route Recon Screen	Hasty Attack		Provide C&C Provide C&C
NOTE: This matrix excerpt shows when the ACR squadron conducts a "Hasty Attack," the troops will perform one of the following four missions: "Conduct a Hasty Attack", "Conduct a Screen", "Conduct a Zone Reconnaissance", or "Conduct a Route Reconnaissance". The specific mission(s) performed by the troops depends on the tactical situation and the squadron commander's intent.				

(2) The training developer would repeat the process with each of the echelons. Table 12 is an excerpt from a Headquarters and Headquarters Troop (HHT) mission matrix.

TABLE 12. **HHT mission matrix**.

HHT	TOC	S4 SEC	MAINT PLT
Provide C&C Provide C&S	Provide C&C Provide C&C	Provide Log Spt	Provide Recovery Repair/Service Parts
Move	Occupy TOC Site Move TOC		

(3) The steps for developing the mission matrix are:

(a) Determine the missions for the highest echelon. Determine what missions the next lower echelons are performing to support each of the missions of the higher echelon.
(b) Repeat the process, in top-down fashion, until matrices have been developed for all company-level and higher echelons. Matrices should not need to be developed below work center, flight sortie, or platoon level.

g. Record potential tasks. It is likely, as the training developers identify missions and develop the mission diagrams, that they will also identify actions that could later become collective or individual tasks. It is important to go ahead and record the information about these potential tasks until a determination as to its status is made. Local standard operating procedures may dictate the method for recording tasks. The important thing is that the training developers capture all potential tasks for future consideration.
h. Develop final mission list/matrices. As the training developers finalize the missions for the unit, they should check them against the following:

(1) Scrub the mission if it does not support the missions of the next higher echelon or supported unit.
(2) Review each mission to ensure that it accurately reflects what has been learned about the unit in terms of its organization, equipment, and operational environment.
(3) Review each mission to ensure it is complete.
(4) Review all the mission statements to ensure they contain an action verb, an object, and when necessary a qualifier.

6.5.6 Collective task identification. Analyze the missions performed by each echelon to determine the collective tasks required for mission accomplishment. During the mission analysis, some collective tasks were used to "define" the missions performed by each echelon. These collective task lists provide an excellent source for identifying individual tasks. Refine and expand the task lists using the same analytical methods described previously (see 6.5). The following are guidelines for collective task identification:

a. Initially the training developer is not overly concerned about recording proper task titles. Titles are refined after all the tasks have been identified. Expect to go through several reviews, refining, and modifying the list before finalizing the task list. A task is defined as a collective task if it:

   (1) Requires more than one individual to complete, with each individual performing a discrete part of the task.
   (2) Has identifiable start and end points.
   (3) Results in a measurable, observable product or accomplishment.
   (4) Requires simultaneous performance of task steps in different locations or contains such a large number of skills that one person cannot perform it in a timely or effective manner. When making a decision concerning timeliness and/or effectiveness, maintain objectivity.

b. The training developer should retain the following information about each collective task as the inventory is developed:

   (1) Specific source from which the task came.
   (2) Unit designation.
   (3) Temporary task number.
   (4) Mission(s) supported.
   (5) Mission in which task is performed.
   (6) Initial task title.
   (7) Echelon(s) that perform the task.
   (8) Duty position(s) (if an individual task) that performs the task.
   (9) Description of start and stop points of the task.

c. Describe tasks in a standard format called a task title on the final task inventory. Preparing the task title in a standard format ensures that the intended action is clearly described and the action is specific and measurable. The wording of the task title consists of the same components as the mission statement. For example, "Recover (action verb) a vehicle (object) by Similar Vehicle (qualifier)". Refer to Table 13 for development of task statements.

6.5.6.1 Techniques for identifying collective tasks. Identifying all the collective tasks for the mission is easier if a systematic technique is applied when using one of the analysis methods discussed in Appendix B. A technique that would allow the training developers to organize their thoughts when identifying collective tasks is to divide the mission into segments or mission activities and deal with each separately. The technique that is chosen is a personal one; it should suit your needs. It may be necessary to develop your own technique for organizing your thoughts. As a technique is applied, remember to consider the actions of interacting units while

analyzing the mission and what impact they might have on the tasks being performed by the echelon with which you are dealing.

6.5.7 Collective task analysis. Once the collective tasks are identified, they need to be analyzed and task statements developed. The process for developing collective task statements, determining which tasks should be trained, and the standard to which they are to be performed is the same as for individual task analysis.

6.6 Job analysis. Whether developing a new training course or updating an existing course, data must be collected that will allow a job analysis to be conducted. Job analysis is a method used to obtain a detailed listing of tasks necessary to perform a specific job or duty. Job related data should include its purpose, functional responsibility of personnel, required support equipment and materials, and information on how the system works, is maintained, or is used. Collecting this data may involve observing personnel in the work environment, interviewing job incumbents and supervisors, questionnaire surveys, jury-of-experts, and the study of applicable occupational field descriptions, related training documents, and engineering data and specifications. See Table 18 for additional items to consider.

6.6.1 Individual task identification. From the data collected during job analysis, begin the documentation of task statements. (See, paragraph 6.7 for guidance on the analysis and development of task statements).

6.6.2 Individual task analysis. Once the individual tasks are identified, they need to be analyzed and task statements developed. The process for developing individual task statements, determining which tasks should be trained, and the standard to which they are to be performed is the same as for collective task development. (See, 6.7 below).

6.7 Task analysis. Task analysis is the process of detailing task performance. The task performance details should describe how the task is performed (performance steps), under what conditions it is performed, and how well the individual must perform it (performance standards). These task performance details will help the instructional developer establish the individual training strategy and to design and develop the training programs and products.

6.7.1 What is task analysis? In order to understand task analysis, the definition of a task is needed. A task is "A single unit of specific work behavior, with clear beginning and ending points, that is directly observable or otherwise measurable. A task is performed for its own sake, that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a mission, duty or job." It may also be defined as a series of actions leading to a terminal outcome, such as "starting engines on an aircraft" or "performing an aborted take-off." Task analysis is the process of breaking a task down to identify the:

a. Component steps of a task.

b. Sequence of those steps.
c. Conditions under which the task will be performed (i.e., at night, in the field).
d. Task cues.
e. Standard of performance that must be achieved, expressed in terms of accuracy, completeness, sequence, or speed.

6.7.1.1 Different concepts of task analysis. MIL-HDBK-1908, Department of Defense Handbook, Definitions of Human Factors Terms provides a definition for task analysis that describes a process different (more complex) from what is described in this handbook. Humans factors task analysis is the process of taking a mission for a team, crew, or individual normally utilizing an item of materiel or equipment (e.g., an aircraft, tank, vehicle, weapon system, etc.). The mission is then broken down into functions. Each function is then broken down into as many layers of tasks (i.e., identifiable units of work) as necessary to fully understand all of the human performance requirements for operating, maintaining, or employing that item of material or equipment. This breakdown includes all interfaces, and interactions between the human and the equipment, and between the individual and other individuals involved in the mission. This kind of analysis produces valuable information but provides a list of tasks and subtasks far too detailed and lengthy for instructors to provide to students as a basis for preparing them for mission or job performance. Instructional developers should use any available task analysis generated as part of the human factors determination process as a beginning point for their task identification and analysis processes. The concept of a task used in training development is often a much larger unit of work than the almost infinite breakdown of task and subtasks identified in human factors task analysis. The exact level of the breakdown in a human factors analysis that instructors can use to identify task titles for insertion into the candidate list will vary depending on the breadth of the occupation into which the task will be inserted. The tasks and subtasks identified by human factors analysis become a source for identifying task steps and skill and knowledge requirements. The time and relationship information produced in human factor s task analysis provides valuable information for establishing standards and task criticality justification.

6.7.2 Purpose of task analysis. During task analysis, each task is examined to determine performance requirements. The products of task analysis are lists of all tasks, the equipment or materials involved with each task, the conditions under which the tasks must be performed, and the standards that must be met. Also during task analysis a determination is made of how often the tasks are performed, safety requirements, how critical the task is, its complexity, and the difficulty of learning the task. This information is used to select tasks for training and develop the course LOs.

6.7.3 Guidelines for identifying tasks. Understanding task criteria will help identify tasks during task analysis. Examples of task criteria are as follows:

a. A task is a group of related activities (subtasks) directed toward a goal.
b. A task has a definite beginning and end.

c. A task involves people interacting with equipment, media, data and other people.
d. A task is directly observable or otherwise measurable.
e. A task is not dependent on other tasks.
f. A task results in a meaningful product.
g. A task includes a mixture of decisions, perceptions, and/or physical activities required of an individual.
h. A task may be any size or degree of complexity.

6.7.3.1 Task statements. As tasks are identified, the instructional analyst should prepare a task statement in a standard format. Using a standard format will ensure that the intended action is clearly described and the action is specific and measurable. The wording of the task statement consists of an action verb, an object, and possible qualifiers (optional). For example, "Plan (action verb) for the collection of combat intelligence (object) to support tactical operations at the task group level (qualifier)" is a statement that contains all three parts. Specific steps to identify tasks are as follows:

a. Select data collection method(s). (See Appendix B for guidance on data collection methods.)
b. Careful selection of the best possible action verb during data collection will assist in the writing of LOs. Refer to the verb list in Table 13 to select the most appropriate verb.
c. Review other task lists of similar jobs prepared for other training courses.
d. Determine start and stop points for the task. This will help determine the next possible task.
e. Record the task statement. See Table 14 for guidelines on writing task statements.
f. Record the source of origination for the task statement.
g. Review all tasks for each job to ensure that no gaps exist and task overlap/redundancy is minimal.

6.7.3.2 Action verb list. Table 13 provides a job aid for the selection of action verbs for task statements and LOs. Table 13 presents the three learning types (i.e., KSA). Each of the three learning types is divided into a hierarchy consisting of learning levels that progress from the simple to the complex. In Table 13 there are two columns under each learning type. The left column should be used in selecting action verbs. The right column provided the learning level associated with each action verb, and a definition of the learning level. The use of standardized, well-defined verbs that provide clarity, will prevent duplicate work and aid in providing quality training. Standardized verbs allow analysts, developers, instructors, and students to understand precisely what the task or LO means. Also, use of the verbs as organized in Table 13 facilitates computer-automated analysis of course task lists and LOs to provide graphic displays of the learning types and levels of a course. These displays would be useful in course diagnosis and course selection from Defense Instructional Technology Information System (DITIS) or training course repositories.

TABLE 13. **Job aid for selecting action verbs**

KNOWLEDGE				
Verbs				Learning Level and Definition
Advise	Elaborate	List	Recount	**Learning Level:** Fact Learning **Definition:** Verbal or symbolic information (e.g., names, formulas, facts, etc.).
Answer	Express	Name	Specify	
Brief	Identify	Read	State	
Calculate	Inform	Recall	Tell	
Define	Instruct	Recommend		
Appraise	Compute	Evaluate	Measure	**Learning Level:** Rule Learning **Definition:** Using two or more facts in a manner that provides regularity of behavior in an infinite variation of situations.
Compile	Encrypt	Format	Outline	
Compose	Estimate	Forward	Route	
Check	Delete	Pause	Start	**Learning Level:** Procedure Learning **Definition:** Performing step-by-step actions in the proper sequence.
Condense	Implement	Resume	Stop	
Edit	Initiate	Set up		
Allocate	Correlate	Finalize	Reorganize	**Learning Level:** Discrimination Learning **Definition:** Grouping similar and dissimilar items according to their distinct characteristics.
Arrange	Cross-check	Group	Restate	
Assign	Designate	Label	Schedule	
Categorize	Differentiate	Level	Select	
Classify	Discriminate	Match	Separate	
Collate	Distinguish	Organize	Sort	
Compare	Distribute	Rank	Task	
Confirm	Divide	Realign	Template	
Consolidate	Eliminate	Redistribute	Translate	
Contrast	Extract	Reexamine	Tune	
Analyze	Derive	Generate	Project	**Learning Level:** Problem Solving **Definition:** Synthesizing lower levels of knowledge for the resolution of problems.
Annotate	Design	Hypothesize	Resolve	
Apply	Determine	Illustrate	Revise	
Change	Diagram	Infer	Search	
Combine	Discover	Investigate	Solve	
Conclude	Draft	Locate	Summarize	
Convert	Effect	Manipulate	Synthesize	
Create	Explain	Modify	Triage	
Criticize	Extend	Plan	Use	
Decide	Find	Predict	War game	
Defend	Generalize	Produce		
SKILLS				
Verbs				Learning Levels and Definition
Detect	Hear	See	Taste	**Learning Level:** Perception (Encoding) **Definition:** Sensory stimuli that translate into physical performance.
Feel	Scan	Smell	Visualize	
Assault	Fall	Pull	Throw	**Learning Level:** Gross Motor Skills **Definition:** Manual dexterity in the performance of physical skills.
Carry	Hold	Run	Turn	
Creep	Jump	Stay	Twist	
Depart	Lift	Swim	Wear	
Advance	Guide	Maneuver	Take off	**Learning Level:** Continuous Movement **Definition:** Tracking or making compensatory movements based on feedback.
Control	Hover	Regulate	Track	
Follow	Land	Steer	Traverse	
Able	Cross	Prepare	Set	**Learning Level:** Readiness **Definition:** Having readiness to take a particular action.
Assist	Delay	Prime	Stand to	
Challenge	Guard	Ready		

TABLE 13. **Job aid for selecting action verbs - Continued.**

SKILLS - Continued				
Verbs				Learning Levels and Definition
Access	Dispose	Mount	Rotate	**Learning Level:** Mechanism **Definition:** Performing a complex physical or mental skill.
Activate	Disseminate	Move	Save	
Actuate	Drive	Navigate	Secure	
Adjust	Egress	Obtain	Send	
Administer	Elevate	Open	Service	
Align	Emplace	Operate	Shut down	
Archive	Employ	Order	Sight	
Arm	Engage	Park	Signal	
Assemble	Energize	Perform	Splint	
Attach	Enter	Place	Squeeze	
Balance	Establish	Plot	Stockpile	
Breach	Evacuate	Police	Store	
Calibrate	Exchange	Position	Stow	
Camouflage	Fill out	Post	Strike	
Center	Fire	Press	Submit	
Charge	Fit	Pressurize	Supervise	
Clean	Fuel	Process	Support	
Clear	Ground	Procure	Sweep	
Close	Harden	Provide	Take	
Collect	Hoist	Publish	Take charge	
Connect	Initialize	Raise	Tap	
Cover	Input	Range	Test	
Debrief	Insert	Reach	Tighten	
Debug	Inspect	Receive	Trace	
Decontaminate	Install	Record	Transfer	
Deliver	Integrate	Reestablish	Transmit	
Destroy	Intercept	Refuel	Transport	
Diagnose	Isolate	Release	Treat	
Dig	Issue	Relocate	Troubleshoot	
Disassemble	Jack	Remove	Type	
Disconnect	Launch	Repair	Unload	
Disengage	Load	Replace	Update	
Dismantle	Log	Replenish	Utilize	
Dispatch	Lubricate	Reset	Write	
Displace	Maintain	Retrieve	Zero	
Display	Manage	Return		
Acclimatize	Direct	Occupy	Reconcile	**Learning Level:** Adaptation **Definition:** Modifying a complex physical or mental skill to accommodate a new situation.
Accommodate	Draw	Orient	Recover	
Adapt	Evade	Pack	Reduce	
Ambush	Infiltrate	Patrol	Relieve	
Attack	Lay	Prevent	Suppress	
Bypass	Lead	Program	Tailor	
Conduct	Map	Protect	Temper	
Deploy	Neutralize	Queue	Train	
Cause	Contrive	Initiate	Make	**Learning Level:** Origination **Definition:** Creating a new complex physical or mental skill to accommodate a new situation.
Construct	Correct	Invent	Originate	

TABLE 13. **Job aid for selecting action verbs - Continued.**

ATTITUDES				
Verbs				Learning level and Definition
Attend closely Listen Listen attentively	Monitor Observe Perceive Recognize	Reconnoiter Show awareness	Show sensitivity Wait	**Learning Level:** Receiving (Perception; Situation Awareness) **Definition:** Demonstrating mental preparedness to perceive the normal, abnormal, and emergency condition cues associated with the performance of an operational procedure.
Accomplish Achieve Acknowledge Announce Ask Communicate Complete	Complete assignment Comply Demonstrate Describe Encode Execute	Give Indicate Interpret Notify Obey rules React Report	Request Respond Resume Show	**Learning Level**: Responding (Interpreting) **Definition:** Demonstrating mental preparedness to encode operational cues as indicators of normal, abnormal, and emergency conditions associated with the performance of an operational procedure**.**
Alert Appreciate Approve Assess Authenticate	Belief Cancel Choose Judge Justify	Prioritize Propose Qualify Reassess Review	Share Study Validate Verify	**Learning Level:** Valuing (Judgment) **Definition:** Demonstrating the ability to judge the worth or quality of normal, abnormal, and emergency cues associated with the performance of an operational procedure.
Allow Alter Assume	Command Coordinate Enforce	Ensure Influence Prescribe	Serve	**Learning Level:** Competence (Application of resource management strategies and tactics.) **Definition**: Demonstrating the mental preparedness to make decisions using prioritized strategies and tactics in response to normal, abnormal, and emergency condition cues associated with the performance of operational procedures.
Conceive Conjecture	Develop Devise	Formulate Imagine	Innovate	**Learning Level:** Innovation (Generation of new resource management strategies and tactics) **Definition:** Demonstrating the mental preparedness to make decisions by generating the results expected upon completion of prioritized strategies or tactics in response to normal, abnormal, and emergency cues associated with performance of an operational procedure, and generating prioritized strategies and tactics in response to abnormal or emergency cues.

6.7.3.3 Task statement quality. Task statements should be clear, complete, concise, and relevant to the performance action. Generally, when selecting action verbs for collective and individual task statements (and to a lesser degree, sub-task statements), use skill type verbs from Table 13. For educational and occupational task statements, all verbs in Table 13 are candidates. Table 14 provides some guidelines that will help in writing task statements.

TABLE 14. **Guidelines for writing task statements**.

CRITERIA	GUIDELINES	EXAMPLE
Clarity	Use wording that is easily understood.	"Compare written description to actual performance." **NOT** "Relate results to needs of field."
	Be precise so it means the same thing to all personnel.	Use words such as "check, coordinate, assist" with caution - they are vague.
	Write separate, specific statements for each task. Avoid combining vague items of skill, knowledge, or responsibility.	"Sort files." "Maintain files." **NOT** "Have responsibility for maintaining files."
Completeness	Use abbreviations only after spelling out the term.	"Perform War-Readiness Material (WRM) inventory" may be followed by "Prepare requisitions for WRM."
	Include both form and title number when the task is to complete a form, unless all that is needed is the general type of form.	"Complete Task Description Work Sheet (Form No. XXX)."
Conciseness	Be brief.	"Prepare Engineering Change Proposal (ECP) (DD Form 1692)." **NOT** "Accomplish necessary reports involved in the process of maintaining production and control procedures."
	Begin with an imperative present-tense verb (the subject "You" is understood).	"Repair" or "Write"
	Indicate an object of the action to be performed.	"Repair engine." "Write report."
	Use current job task terminology.	"Use most recent military documentation."
Relevance	Do not state a person's qualifications.	"Perform backup of computer files." **NOT** "Has one year computer training."
	Do not include items on receiving instructions, unless actual work is performed.	"Prepare lab report." **NOT** "Attend lecture."

6.7.3.4 Guidelines for identifying subtasks. Generally, when selecting action verbs for lower level sub-task statements, knowledge or attitude verbs from Table 13 will be more applicable. However, skill verbs are also appropriate for subtasks. An example of subtasks that make up a task is provided in Table 15. There are three basic guidelines for identifying subtasks:

a. Examine each task statement to see if it contains more than one group of activities that must be performed sequentially or independently.
b. Review the complete list of subtasks for each task. Ensure that subtasks do not overlap and that together they account for all required performance.
c. Ensure all terminal objectives are skill tasks, with a hierarchy of sub-skills (as applicable). Ensure that each task and sub-task has a hierarchy of knowledge and attitudes.

TABLE 15. **Identifying subtasks**.

EXAMPLE OF SUBTASKS
Job - - Perform avionics maintenance.
Duty - - Maintain XYZ communications system.
Task - - Perform diagnostic test.
Subtasks:
1. Connect communication system to the tester.
2. Execute the test.
3. Analyze test results.

6.7.3.4.1 Identify sequential subtasks. When identifying subtasks, be aware that some subtasks must be performed sequentially while others can be performed independently. Examples are provided in Table 16.

TABLE 16. **Sequentially and independently performed subtasks**.

SEQUENTIALLY PERFORMED SUBTASKS	**INDEPENDENTLY PERFORMED SUBTASKS**
Task - Perform C-12 takeoff and climb	Task - Take corrective action in response to aircraft malfunctions
Subtasks • Perform takeoff. • Execute a climb. • Maintain aircraft at assigned altitude.	Subtasks • Observe abnormal indications. • Determine corrective action alternatives. • Advise passengers on emergency procedures.

6.7.3.5 Identify subtask elements (task steps). The development of task steps requires identifying the particular components of the task. A task step is a discrete action that is required to fully perform an individual task. These task steps should be listed in the same order as they would occur during task performance. Task steps focus upon processes, procedures, and results. Each task step should be specific, detailed, and contain only one action. The following process can be followed to help develop task steps:

a. Review the collected data to determine how the task is performed.
b. Sequence all steps as they should be performed on the job.
c. For each task step, identify any skill (physical or mental) and knowledge (mental) components needed by the individual to ensure task step accomplishment. For example, in order to "Report enemy contact" (a step) as part of "Conduct actions on contact" (a task), the individual must follow radio procedures (knowledge). The knowledge and skills are tied to the step to which they apply. The instructional analyst needs to annotate the "K" (knowledge), "S" (skill), and "A" (attitude) to the task steps. Table 13 provides support for determining the KSA factors. Generally the knowledge or attitude related action verbs are more applicable for task steps than skill related verbs.
d. Identify the mistakes an inexperienced performer usually makes to help identify the required knowledge and skills. The identification of knowledge and skills is critical for the instructional analyst during the design phase because the sequencing of training relies heavily on prerequisite relationships.
e. Identify the physical requirements (e.g., skill, speed, strength, stamina, suppleness, etc.). Design training to prepare the individual to perform the task under the conditions and frequency that they will be expected to encounter during actual job performance.
f. Identify the reference for each task step. (This is especially important if more than one source is used or if the source was a SME rather than a document. Include only the publication's number and the referenced pages.)
g. Ensure each step has only one activity. For example, "Develop and implement a defense plan." does not meet this criterion. Review each procedural task step to make certain the reference states a specific procedure for performing the activity. If steps are referenced, rather than listing them, make sure the steps are complete in the manual. List any knowledge, skills, or attitude, safety, and environmental factors not included in the manual.
h. Review the steps that require coordination to make certain that they state the reason for coordination and with whom the coordination is required. Do not use an ambiguous term such as "higher authority."
i. Review the total list of task steps to ensure no performance gaps or overlaps exist between the steps.

6.7.4 Determine if the task is shared or job specific. If the task is job specific, the analysis is a relatively straightforward process. If the task is common or shared, the instructional analyst should consider whether individuals perform the task in exactly the same way. Minor

differences, if any, should be addressed with task steps. If there are major differences, the instructional analyst may need to re-evaluate whether there should be more than one task to represent the action taken by different jobholders.

a. The following are examples of shared tasks:

(1) Observe electrical safety precautions.
(2) Select tools.
(3) Start the engine.

b. The following are examples of job specific tasks:

(1) Install the C-130 engine.
(2) Perform F-123 take off.
(3) Remove the AN/ALQ-123 radar.

6.7.5 Develop task performance criteria. Task performance criteria includes the condition under which the task is to be performed, the cues that trigger the task performance requirement, and the standards to which the task is to be performed. The criteria also includes the measures that will be used to determine if the task was performed correctly.

6.7.5.1 Define task conditions. The condition statement sets the stage for performing the task and also supports analyzing the task. Conditions, as used here, refer to the job conditions that significantly influence job performance. Those significant on-the-job conditions provide the basis for determining the necessary training conditions. The major items that need to be included in an accurate and complete statement of task conditions are listed in Table 17. Examples of task conditions are as follows:

a. A jobholder is required to multiply three-digit numbers. This statement alone suggests the possible need for training in mathematics. However, if one of the conditions of the task is that the individual performing the task is provided a calculator, the implications for training is considerably different.
b. Another task might require attaching cables to various items so that the items can be lifted. If one of the conditions of the task is that this must be accomplished 200 feet under water, this has serious implications for training.

TABLE 17. **Guidelines for documenting task conditions**.

INCLUDE IN TASK CONDITION STATEMENT	EXAMPLES
1. Tools and equipment used to perform the task.	1 Cleanroom overalls. 2 Lead-lined gloves. 3 F-16 aircraft. 4 Soldering iron.
2. Special job aids and manuals.	1 Procedural checklists. 2 Technical manuals.
3. Type and amount of supervision and assistance normally available during task performance.	1 Task performed independently. 2 Task performed under close supervision. 3 Task performed as a member of a team.
4. Special physical demands of the task.	1 Crowded working conditions. 2 Unusual or prolonged physical exertion. 3 Kneeling or squatting. 4 Unusually cramped position.
5. Environmental conditions that influence task completion.	1 Tropical environment. 2 Arctic environment. 3 Desert environment.
6. Location of performance.	1 Air-conditioned building. 2 Outdoors in all weather conditions. 3 At night in total darkness. 4 Direct support maintenance van.
7. Operations tempo	1. Normal. 2. Emergency. 3. Combat. 4. Operations Other Than War (OOTW).

6.7.5.2 Define cues. The cue is an action or event that creates the necessity for a task to be performed, regulated, or stopped. Adequate job performance clearly consists of more than performing the work elements that make up the tasks that make up the job. The correct order and appropriateness of performance depend upon proper recognition of cues and upon knowledge of the correct response to each cue. This information will aid the training developer in designing learning activities that attempt to duplicate or simulate the work environment. A task may have one or more cues. For example:

a. For a wheeled vehicle, a flat tire would be a cue that should result in changing or repairing the tire. Other cues, such as length of time before the vehicle must be driven, location of the vehicle, and availability of a spare tire would determine which of several

actions should be taken; that is, whether the tire should be changed and repaired later, or whether it should be immediately repaired.

b. Sometimes, the cue is verbal, such as "Smith, fix that engine", or "Smith, replace the spark plugs", etc.

6.7.5.3 Identify job hazards, safety, and environmental factors. Document whether there is a hazard potential to personnel, equipment, and/or environment when this task is performed. Also indicate if personnel performing this task are required to hold a specific certification and the name of the agency that issues the certification.

6.7.5.4 Define task standards. The task standards state the performance criteria for the task. Task standards describe the minimum acceptable level of task performance to include accuracy, speed, quantity, and quality that will ensure successful accomplishment of the task. Standards should be objective, observable, measurable, and should relate to the task under study. Some guidelines for developing task standards are as follows:

a. The standard for a task is a statement of how well the task must be performed, if and when it is performed. For example, a task may be "Destroy enemy fortification with a missile". The job analyst is not likely to see the task performed and cannot write the standard for the task based on observation of satisfactory performance. The standard for this task is how well the task must be accomplished when it is performed.
b. The standard of performance for a task can be described by defining an acceptable product, by defining an acceptable process, or by defining both.
c. The standard should be defined in terms of an acceptable product if:

    (1) The product is observable and can be inspected.
    (2) The process by which the product was produced cannot be easily observed.
    (3) The process is relatively unimportant as compared to the product.

d. Some examples of tasks where the standards should be defined in terms of a product are:

    (1) Prepare a tactical operations plan.
    (2) Develop a computer program.
    (3) Dig a trench 5 feet deep, 25 feet long, and 3 feet wide.

e. Standards generally describe products in terms of quantity (that is the number of work units produced per time unit), accuracy, tolerances, completeness, format, number of errors, and/or clarity.
f. The standard should be defined in terms of an acceptable process if:

    (1) Performance of the task does not leave a readily observable product.

(2) Failure to use the correct process could result in damage to equipment or danger to personnel.

g. Some examples of tasks where the standards should be defined in terms of process are:

(1) Perform cardio-pulmonary resuscitation.
(2) Defuse defective bomb.
(3) Land aircraft on flight deck.

h. Process standards generally are described in terms of sequence, completeness, accuracy, and speed of performance.
i. Often, both product and process are important. For example:

(1) If a task requires that a motor vehicle be driven from point A to point B, the arrival of the vehicle at point B could provide a product standard. However, since the driver might have run 10 other vehicles off the highway in the process, the product standard alone would not be sufficient. Therefore, the task statement "Drive a vehicle from Point A to Point B without incident." would specify both product and process.

j. Standards should be documented in sufficient detail to accurately communicate the requirements of the job. Often, to simplify writing the standards statements, a number of implied standards are not included in the documentation but are intended to be a part of the standards. Some of these implied standards are "complete and accurate," "submitted on time," and "correct solution." This means that for some tasks, the standard of performance is implied in the task statement and need not be listed as a separate item.
k. The instructional analyst should ensure that the standards are measurable and objective. Standards such as "maintains momentum of..." cannot be measured. Subjective standards like "As Soon As Possible (ASAP)" are inadequate, because one evaluator's concept of "ASAP" may be different from another evaluator's. Time should not be used as a part of the standard unless failure to perform within the given time has dire results.
l. Perform the following steps to develop task standards:

(1) Review the condition statement to determine the parameters for the standard. The standard cannot address anything outside the parameters set by the condition statement.
(2) Review the task steps; task steps are the basis for task standard development. The task standard can only address what is stated in these steps. Ask the question "What is the ultimate outcome of the performance of these task steps?" The answer is the basis of the task standard.
(3) Review the information sources to determine if any standards are stated in these sources.

(4) Review the completed task standard to ensure that it states the criteria for the task, relates to the task steps, and is within the parameters set by the condition statement.

6.7.5.5 Develop performance measures. Performance measures are the behaviors, products, and characteristics that an evaluator observes to determine if the person has performed a task correctly. Successful accomplishment of performance measures results in meeting the task standard. Perform the following steps to determine performance measures:

a. Review the task steps, knowledge, skills, and attitude requirements to evaluate which are major steps. Performance measures are usually the major performance steps, knowledge, and skills necessary to perform the task.
b. Select performance measures that are observable and measurable. Performance measures should support the standard.
c. Write the performance measures to ensure that an evaluator could use them to determine if the task performer has in fact accomplished the task to the standard.
d. Begin each performance measure with an action. For example, "Mark all errors in grammar, spelling, and format," not "The letter must be reviewed to see that it is correct."
e. Ensure each performance measure concerns only one event.

6.8 Selecting tasks that require training. Once the tasks and subtasks (task steps) have been identified, it is necessary to select those tasks that require training. Usually a panel of ISD/SAT experts and SMEs will perform the selection. Based on criteria established, the panel will categorize the tasks according to those requiring initial training, intermediate training, advanced training, On-the-Job Training (OJT), job aids, and no training. Examples of several models are provided at the end of this section. These examples may be helpful during task analysis and the selection of tasks for training. Also, Table 18 supports the training task selection process, and also supports the development of sub-tasks and enabling LOs.

6.8.1 Establish task selection criteria. It is likely that information will be collected on many tasks that do not require training. Therefore, part of the data to be collected must establish criteria that will help in the selection of the tasks that require training. The following criteria are presented as an aid in selecting tasks for training. These criteria are not intended to be all-inclusive; tasks may require different or additional criteria. However, the following will provide a good starting point.

6.8.1.1 Safety hazard severity. Safety hazard severity is a qualitative measure of the potential consequences resulting from item failure. Severity classification categories are defined as follows:

a. Minor. A failure not serious enough to cause injury, property damage, or system damage but will result in unscheduled maintenance or repair.

b. Marginal. A failure that may cause minor injury, minor property damage, or minor system damage will result in delay or loss of availability or mission degradation.
c. Critical. A failure that may cause severe injury, major property damage, or major system damage will result in mission loss.
d. Catastrophic. A failure that may cause death or system loss (e.g., aircraft, tank, missile, ship, etc.).

6.8.1.2 Criticality of performance. The criticality of performance points to the need for selecting tasks for training that are essential to job performance, when required, even though the tasks may not be performed frequently. Criticality is a measure of how essential a task is to job performance. The consequences of inadequate performance on certain tasks could result in injury to personnel, loss of life, or damage to equipment. Inadequate performance could have a serious impact on the mission, the operation, the product, the equipment, or the operator. For example, the probable consequences of inadequate performance of such combat tasks as "Identifying enemy aircraft." could be loss of life and equipment. Another example, the probable criticality of performance of the task "Write trip report." is negligible. If this task were selected for training, it would be on the basis of factors other that probable criticality of performance. To obtain data on this criterion, individuals who are familiar with the job are asked to rate probable consequences of inadequate task performance according to the categories listed below:

a. Minor. The consequence of inadequate task performance results in no injury to personnel or damage to equipment.
b. Marginal. The consequence of inadequate task performance results in non-serious personnel injury or damage to equipment.
c. Critical. The consequence of inadequate task performance results in serious or life-threatening injury to personnel, or impedes the ability to perform a mission.
d. Catastrophic. The consequence of inadequate task performance results in death or being unable to carry out a mission.

6.8.1.3 Task delay tolerance. Task delay tolerance is a measure of how much time can elapse between the time the need for task performance becomes evident and the time actual performance must begin. There are some tasks encountered by job incumbents, as part of their normal job, in which no delay of task performance can be tolerated. The job incumbent must be capable of performing the task, without taking time to read how the task is done or finding someone to provide advice. For other tasks a minor delay might be acceptable, or even mandatory, while the job incumbent gets advice, checks technical orders, regulations, etc. For some tasks, there may be time to assemble a group of experts to confer with before proceeding. Some examples of task delay tolerance are as follows:

a. Tasks determined to have a low delay tolerance should be given relatively high priority for selection for training. The following are examples of low delay tolerance tasks requiring immediate performance:

(1) Use artificial respiration to restore the breathing of an accident victim.
(2) Pull ripcord of emergency parachute if main parachute fails.
(3) Extinguish fire in aircraft engine during startup on flight line.

b. A high delay tolerance does not exclude a task from training, but indicates that other factors will be more of a basis for acceptance or rejection. To obtain data on this criterion, individuals who are familiar with the job are asked to rate the amount of delay that can be tolerated before performance begins. Examples of tasks having a higher delay tolerance, thereby permitting delay in performance, would include:

(1) Review books for unit library.
(2) Refill fire extinguisher after use.
(3) Write trip report.

6.8.1.4 Frequency of performance. This is a measure of how often the task is performed. While the probable consequences of inadequate performance of a particular task are serious and the task delay tolerance is low, the task may still rate low for training priority if it is rarely performed. A practical way to collect frequency of performance data on tasks is to rate their frequency of performance on a scale such as the following:

a. At least annually.
b. At least once every 6 months.
c. At least monthly, but less than twice per week.
d. Twice per week or more.

6.8.1.5 Probability of inadequate performance. This is a measure of how often a task is performed in a non-acceptable manner. The criterion for probability of inadequate performance is used to ensure that training is given to those essential tasks that job incumbents frequently perform poorly. By recording the judgments of knowledgeable personnel regarding the probability of deficient performance, a list of these poorly performed tasks can be produced. Training of these tasks, regardless of their criticality, must be given serious consideration. For example, if equipment downtime is often caused by faulty soldering, this skill may require additional emphasis in a list of tasks selected for training maintenance personnel. Another example, if widespread theft of items guarded by security personnel is a problem, the tasks of "guard packages, materials, and property" and "prepare physical security plans" may require additional emphasis. To obtain data on the probability of inadequate performance, supervisors of job incumbents may be asked to rate each task as to how often the task is performed in a non-acceptable manner according to the scale below:

a. Never performed correctly.
b. Less often than other tasks.

c. About as often as other tasks.
d. More often than other tasks.

6.8.1.6 Difficulty of performance. The difficulty of performance of a task refers to the time, effort, and assistance required to achieve performance proficiency. When measuring the difficulty of performance the following criteria is used:

a. No training required.
b. Task requires 1 to 3 days to learn.
c. Task may be learned in 1 to 2 weeks.
d. Task may require up to 1 month or more to learn.

6.8.1.7 Task learning difficulty. Some tasks encountered in each job are so easy or so familiar that they can be readily learned on the job without formal training. At the other extreme, some tasks are so complicated that a job incumbent can perform them adequately only after lengthy, formal training. Other tasks lie somewhere in between these two extremes and require different levels of training.

a. Tasks easy enough to be learned on the job without training might be:

(1) Sweep floors.
(2) Collect food trays from patients in hospital wards.
(3) Distribute unclassified correspondence in an office.

b. Tasks that can require lengthy, formal training might be:

(1) Diagnose malfunction in an airborne radar weapons system.
(2) Defuse unexploded enemy bombs.
(3) Identify parasites in clinical specimens.

6.8.1.7.1 Task learning difficulty scale. To obtain data on the task learning difficulty, job incumbents or others may be asked to rate tasks they perform as to the training time required to achieve proficiency, or to the difficulty of learning the task on the job without formal training. The following rating scale may be used:

1	equals	No training is required.
2	equals	Task requires 1 to 3 days to learn.
3	equals	Task may be learned in 1 to 2 weeks.
4	equals	Task may require up to 1 month or more to learn.

6.8.1.8 Percent performing. This criterion, the percentage of job incumbents who perform the task, points to the need for training tasks that are most often performed on the job. For

example: One task for a weather technician might be "Answer telephone inquiries about the weather." If you found that 96 percent of all weather technicians performed this task, the implications for training would be different than if you found that only 10 percent performed it. In the above example, if only 10 percent of job incumbents perform the task, there is a strong probability that training resources would be wasted if all weather technicians were trained to perform the task. Gathering this data is as simple as asking the question "Do you perform this task?" The following rating scale might be used:

a. 0 to 24% of the personnel perform this task.
b. 25 to 49% of the personnel perform this task.
c. 50 to 74% of the personnel perform this task.
d. 75 to 100% of the personnel perform this task.

6.8.1.9 Percent of time spent performing. The percentage of time spent performing a task is a criterion that points to a need for providing training to assist job incumbents in efficient performance of those tasks on which they spend the most time. Selection of tasks for training based on this criterion offers chances for high payoff in terms of return on training dollars expended. To obtain data for determining the percentage of time spent performing the tasks in a job, inputs are required from a large number of job incumbents. Usually they are not asked to state the percentage of their time spent on each task because such a question would be very difficult to answer. Instead, they are usually asked to rate each task as to the amount of time spent performing it as compared to their other tasks. For example, "Rate the relative amount of time spent performing each task." Relative time spent means the total time spent performing the task compared with the time spent on each of the other tasks. The following rating scale might be used:

a. Task is not performed.
b. Less time spent on this task than most other tasks.
c. Same amount of time spent on this task as most others.
d. More time spent on this task than most others.

6.8.1.10 Immediacy of performance. Immediacy of performance refers to the time interval between completion of training and performance of the task on the job and has some significance in selecting tasks for training. A factor for selecting tasks for training is whether or not there is a high probability of the graduate encountering the task on the job fairly soon after completing training. "Fairly soon" means, in this context, that tasks encountered within the first year after training would, everything else being equal, be weighed more heavily for selection that those not encountered until one to two years later. Consider also the predicted or measured amount of decay of the skill that will take place during the time interval. To obtain data on this criterion, job incumbents and others might be asked to rate the time between job entry and task performance on a scale such as the following:

a. Task first performed within 2 to 4 years after assignment.
b. Task first performed within 1 to 2 years after assignment.
c. Task first performed within 6 months after assignment.
d. Task performed during first 3 months after assignment.

6.8.2 Determine which tasks may be supported by a job aid. Determine which tasks or parts of tasks would not have to be trained if job aids were developed. If the performer can use a job aid to perform the task, then training required for that task may be reduced or even eliminated. Tasks that can easily be performed by using a job aid may be removed from the list of tasks to be trained. The information needed to make these decisions should be contained in the data previously collected. Refer to Appendix C for additional detailed information on the use of job aids.

6.8.2.1 Use of job aids. It is not essential to design a single job aid for use everywhere the task is performed. For example, while the task of "answer telephone inquiries" might easily be performed by using a job aid, the job aid might have to be adapted to local needs. The responsible agency for developing job aids could develop job aids to serve different needs of each using command, or issue an instruction that would assist commands in developing their own job aids. If the job aid is carefully developed, nothing else may be required; the incumbents can satisfactorily perform the task simply by following the aid.

6.8.2.2 Tasks with a high delay tolerance. Some tasks have a high delay tolerance; that is, considerable delay can be tolerated between the time the need for task performance becomes evident and the time actual performance must begin. Such tasks are good candidates for the development of job aids. Some examples with a high delay tolerance include:

a. Replace toner cartridge in laser printer.
b. Calibrate the torque wrench.
c. Perform preventive maintenance on the motor vehicle engine.

6.8.2.3 Other factors affecting job aid decision. Several other factors should be considered when deciding which tasks should have job aids developed. Factors to be considered include:

a. Good candidates for job aids are tasks that follow a relatively set procedure, consist of easy to follow steps, but are not performed often enough to be easily remembered. Frequently performed multiple tasks where procedures are complex, are not good candidates for job aids. Some examples are as follows:

    (1) The jet engine mechanic's task of "tag engine containers" follows a set of procedures of relatively few, simple steps. The actual tag might also be the job aid. Here, the job aid could be a substitute for training.

(2) The jet engine mechanic's task of "install engine in aircraft" is much more complex. While some form of job aid probably is available for double checking critical items, to depend completely on the job aid would be unrealistic. Here, it would be necessary to provide training on the use of the job aid and perhaps training on basic skills.

b. Certain physical conditions such as location, weather, and available space, under which the task must be performed, could make the use of a job aid impractical. Examples of this situation are as follows:

(1) The operator of certain underwater rescue equipment might be in such a cramped position that he would not be able to read a job aid.
(2) If a task must be performed in total darkness, a job aid would be useless.
(3) There might not be room in a tank or submarine for a number of bulky job aids such as those used in maintenance tasks.
(4) Tasks performed in frigid weather or heavy rainfall might not be suitable for job aids or the job aid would have to be specially designed for those conditions.
(5) If the consequences of inadequate performance of a task are severe, and if there is a possibility that the job aid will be lost, damaged, or destroyed, total dependence should not be placed on the job aid.

c. Job aids are not suitable for tasks that require a high degree of physical skill. Some examples of these are as follows:

(1) Hitting a target with a M-16 rifle.
(2) Flying a jet aircraft on a low-level mission.

6.8.2.4 Assessing job aids impact. Using the above factors as a guideline, determine if a job aid should be developed for the particular tasks under consideration. If the decision is not to develop job aids, proceed to the process of selecting tasks for the training task list. If the decision is made to produce a job aid, follow these procedures:

a. Develop and validate the job aid.
b. Determine if use of the job aid by the jobholder changes the conditions under which the task is performed. Revise the task statement to reflect the changes caused by the job aid as needed.
c. If the task can easily be performed by using the job aid, it should not be selected for training, and should be of no further concern. If the task is selected for training, because even with the job aid some training is required, the task should be on the training task list.

6.8.3 Task analysis worksheets. A task analysis worksheet can be in any form that meets the need (i.e., paper-based, computer based). The main consideration is that sufficient data is

collected to perform a task analysis. Table 18 is an example of a task analysis worksheet that can be modified to meet the specific need.

TABLE 18. **Task analysis job aid.**

JOB AID - TASK ANALYSIS WORKSHEET	
Mission or system supported:	
Job:	
Duty:	
Task identifier:	
Task category (collective or individual):	
Collective task supported:	
Occupational specialty(s) performing the task:	
Task title:	
Sequential subtask description:	
TASK ATTRIBUTE:	**DESCRIPTION**
Output (product)	
Standard of performance (time, rate, percent)	
Performance Measures	
Equipment (required to perform task)	
Tools (required to perform task)	
Safety (safety considerations when performing task)	
Cue (what prompts performance)	
Conditions (weather, location, time, etc.)	
Location (where task is performed - aircraft, Operational Flight Trainer (OFT), etc.)	
References (documents used to perform task, i.e., checklist, technical manual)	
Task criticality of performance	
Task frequency of performance	
Probability of inadequate performance	
Training emphasis rating	
Task difficulty of performance	
Task delay tolerance	
Percentage of personnel by occupational specialty performing the task	
Other	
SUBTASK ELEMENT	
Subtask Attribute	**Description**
Skill (that is necessary to perform the task)	
Knowledge (facts, concepts, principles that are required to perform the task)	
Attitude (interest, motivation necessary to perform the task)	

6.8.4 Verify task information. Once the lists of tasks and subtasks have been developed, they should be verified. Several techniques can be used for verifying the lists, as shown in Table 19.

TABLE 19. **Verification techniques.**

FUNCTION	TECHNIQUE
Verifying assembled task lists for an existing job.	• Questionnaires. • SME interviews. • Task observations of performance expert.
Deriving a new task list for a new job.	• Interviews. • Questionnaires. • Simulations. • SME assumptions.

6.8.5 Training task selection. After the task and subtask lists are verified, the tasks to be trained are selected. When selecting the tasks to be trained, several things should be considered. For example, when reviewing the list, consider:

a. Has the knowledge and skill required to perform the task been provided in a prerequisite course or equivalent?
b. Can most job incumbents perform the task without training?
c. How often is the task trained on the job?
d. Will job degradation occur if the task is not trained?
e. Is the task critical to job or mission performance?
f. Is it economical to train the task?
g. Is there enough time to train the task adequately?
h. If individuals are trained to do another task, will they be able to transfer what they have learned to perform this task without additional training?
i. Will geographical, procedural, or environmental conditions make it unreasonable to train all job incumbents to perform the task?
j. Is the number of individuals required to perform the task sufficient? What is the percentage of those performing the task?
k. Is the task difficult to learn? After some experience is the task difficult to learn?
l. If individuals are trained to perform the task, will they remember how to perform the task when they get to the job?

6.8.6 Training task selection models. Many critical task selection models are available for use by the training developers performing task selection analysis. Three of the models are provided in Figures 10a, 10b, and 11. The information available about the tasks and the time available for analysis are important factors to consider in choosing a task selection model.

6.8.6.1 Current, Similar, Subtask (CSS) and the Criticality, Difficulty, Frequency (CDF)

models. The CSS and CDF models are used in the process of selecting tasks for training. They involve analyzing data collected from both supervisors and jobholders. Figures 10a and 10b provide examples of how to use the CSS and CDF models to analyze a task.

6.8.6.1.1 CSS/CDF model advantages and disadvantages. After the CSS and CDF analyses are complete, the tasks selected for training should appear on the training task list. If desired, use other criteria to supplement the results obtained by the CDF analysis. The advantages, disadvantages, and major attributes for using the CDF model to select critical tasks are:

a. Advantages:

(1) There are three straightforward factors.
(2) There is ease of administration.
(3) A small sample is acceptable.
(4) The analysis is simple.
(5) Uses input from supervisors and incumbents.
(6) Degree of complexity is adjustable.

b. Disadvantages:

(1) Model provides a crude instrument for analysis.
(2) Provides only gross task selection recommendations.

c. Major attributes:

(1) Simple rank ordering by category.

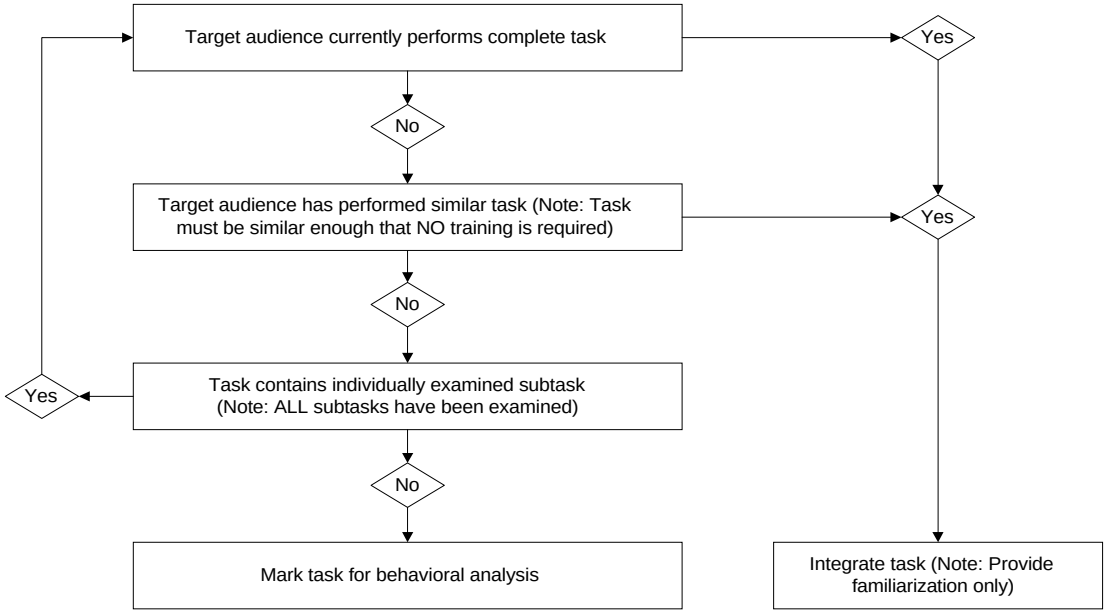

FIGURE 10a. **CSS model.**

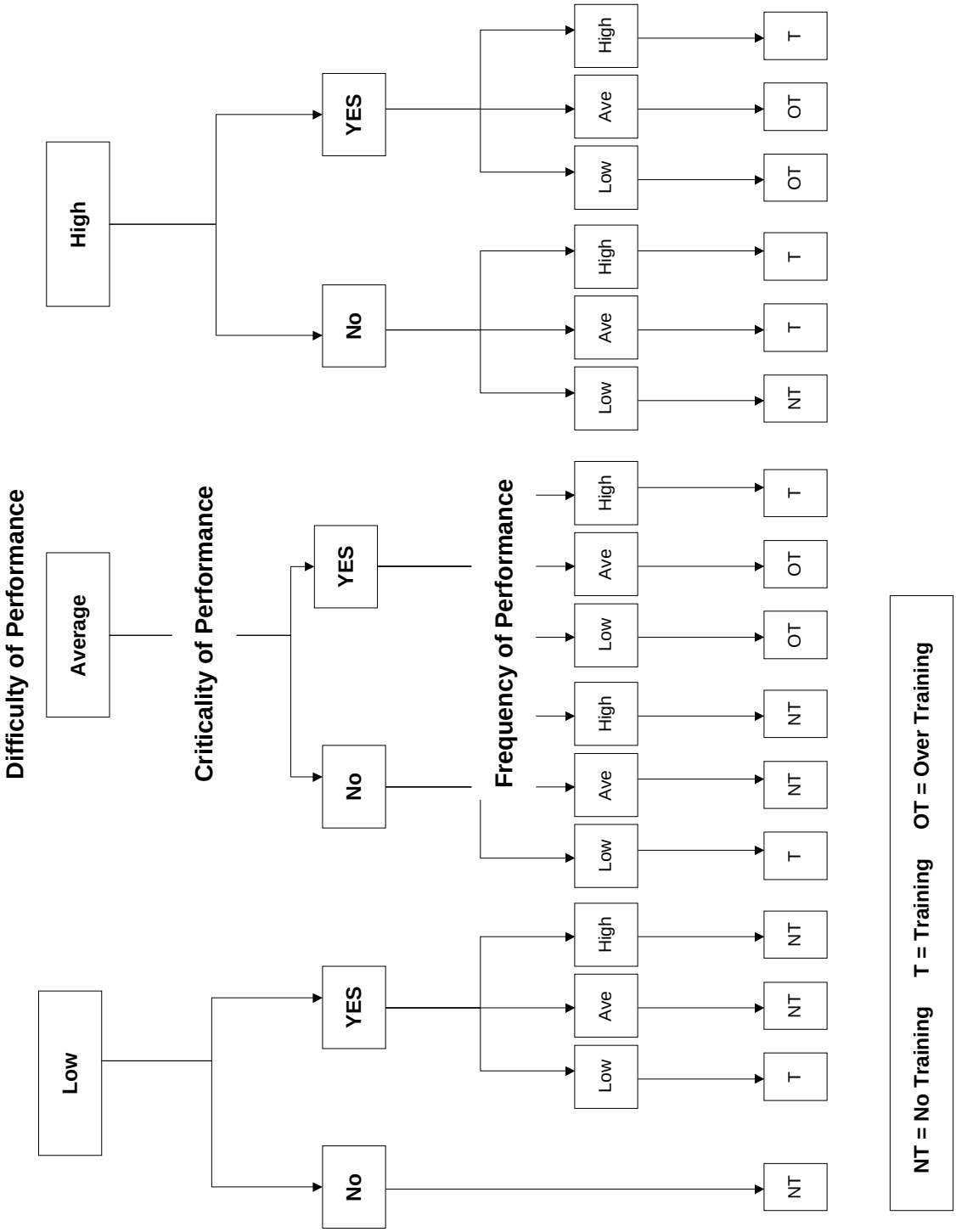

FIGURE 10b. **CDF model.**

6.8.6.2 All Critical Learning (ACL) model. Another name for this model is "Multiple Factor Model". The instructional analyst can tailor the ACL model to fit their requirements. When tailoring the ACL model, remember to select criteria that support making judgments on the selection of tasks for training. If at least four selection criteria are selected from the data collected, there should be a large database to use for selecting tasks for training. Figure 11 provides an example of the ACL model. The following are guidelines for using the ACL model:

a. Select criteria to be evaluated.
b. Assign a weight factor or priority factor to the most important criteria (8 to 1 or 4 to 1, with 8 or 4 being the most critical and 1 the least critical).
c. List the criteria to be used for selection and assigned weight factor on the ACL model sheet.
d List the tasks to be analyzed on the ACL model sheet.
e. Select a task to be analyzed.
f. Review the task analysis worksheets for the criteria listed.
g. Determine the average rating for the criteria for the selected task and multiply the average rating by the weight factor (if any), place the result in the square provided.
h. Once all the criteria ratings are on the form, total them to determine the overall rating for the task and write this rating in the right hand column.
i. Continue this process until all tasks have an overall rating.
j. The tasks with the highest overall ratings should be the tasks selected for training and should be placed on the training task list. The training developer has to determine the cutoff point for the train/no train rating value.

6.8.6.2.1 Advantages and disadvantages of the ACL model. The advantages, disadvantages, and major attributes for using the ACL model to select tasks for training are:

a. Advantages:

(1) Provides a fairly comprehensive set of data for each task.
(2) Probably gives the best analysis of any model.

b. Disadvantages:

(1) Analysis is difficult.
(2) Assigning a weight factor is sometimes difficult and subjective.
(3) Application of the model is time consuming.

c. Major attributes:

(1) An extensive database.

(2) The number of different selection criteria that can be analyzed and combined to determine task selection.

	Selection Criteria									
	Immediacy of performance (A)	Safety Hazard Severity (B)	Criticality of Performance (C)	Frequency of Performance (D)	Probability of Inadequate Perf. (E)	Difficulty of Performance (F)	Task Delay Tolerance (G)	Percent Performing (H)	% of Time Spent Performing (I)	Final Rating
TASK NUMBER										
Task 1										
Task 2										
Task 3										
Task 4										
Task 5										
Task 6										
Task 7										
Task 8										
Task 9										
Task 10										
Task 11										
Task 12										
Task 13										
Task 14										
Task 15										

FIGURE 11. **ACL Model.**

6.8.6.2.2 ACL model data consolidation form. Figure 12 provides an example form that could be used to consolidate data collected on individual ACL model forms.

ACL MODEL DATA CONSOLIDATION FORM									
TASK	**RATING**								
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
A. Service main transmission oil system.									
1. Inspect main transmission oil system.	3.2	3.9	3.0	3.9	3.3	4.0	3.0	4.0	3.2
2. Operational check on main transmission oil system.	3.0	3.3	2.9	3.6	2.8	3.5	2.9	3.5	3.0
B. Service de-ice system.									
1. Remove de-icing valve lever.	2.1	2.2	4.0	3.9	1.0	1.0	4.0	1.0	2.1
2. Service de-ice actuator.	2.0	2.1	3.6	3.5	1.0	1.0	3.6	1.0	2.0
3. Remove actuator lever.	2.3	2.4	3.8	3.6	1.0	1.0	3.8	1.0	2.3
4. Functionally check de-ice switch.	1.9	2.0	3.8	3.9	1.1	.14	3.8	.14	1.9
C. Powertrain system components.									
1. Install tail rotor drive shaft.	1.8	1.7	2.1	1.8	1.9	1.8	2.1	1.8	1.8
2. Install tail rotor gearbox.	1.8	1.7	2.1	1.8	1.9	1.8	2.1	1.8	1.8
3. Install tail rotor hub.	1.8 1.3	1.7 1.6	2.1 1.2	1.8 1.5	1.9 1.4	1.8 1.5	2.1 1.2	1.8 1.5	1.8 1.3
4. Install tail rotor blade assembly.									
NOTES:									

FIGURE 12. **Example of a completed data consolidation form**.

6.9 Categorize tasks. Learning is categorized by levels. Use Table 13 to identify the learning level associated with the task. This will aid the instructional analyst in determining the best methods and media to support instruction of the LOs. The identification of these categories will assist in writing the LOs and selecting appropriate events and activities to support learning. An alternative method for determining task learning categories is provided in Appendix D.

6.10 Analysis process audit and verification. The analysis process provides a means for the review and update of instructional systems. These verification process checklist include the development and revision of task that has changed or is new.

7. ISD/SAT DESIGN PROCESS

7.1 General. During the design phase, the team will build the framework for the training by developing LOs and designing the instruction. What is done here plays a key role in determining the effectiveness and cost-efficiency of the training developed in the next phase of the ISD/SAT process. The quality of the process and products are of concern during the design phase, as well as throughout the entire process. An ISD/SAT model with the design phase highlighted is presented in Figure 13 to help visualize the ISD/SAT process.

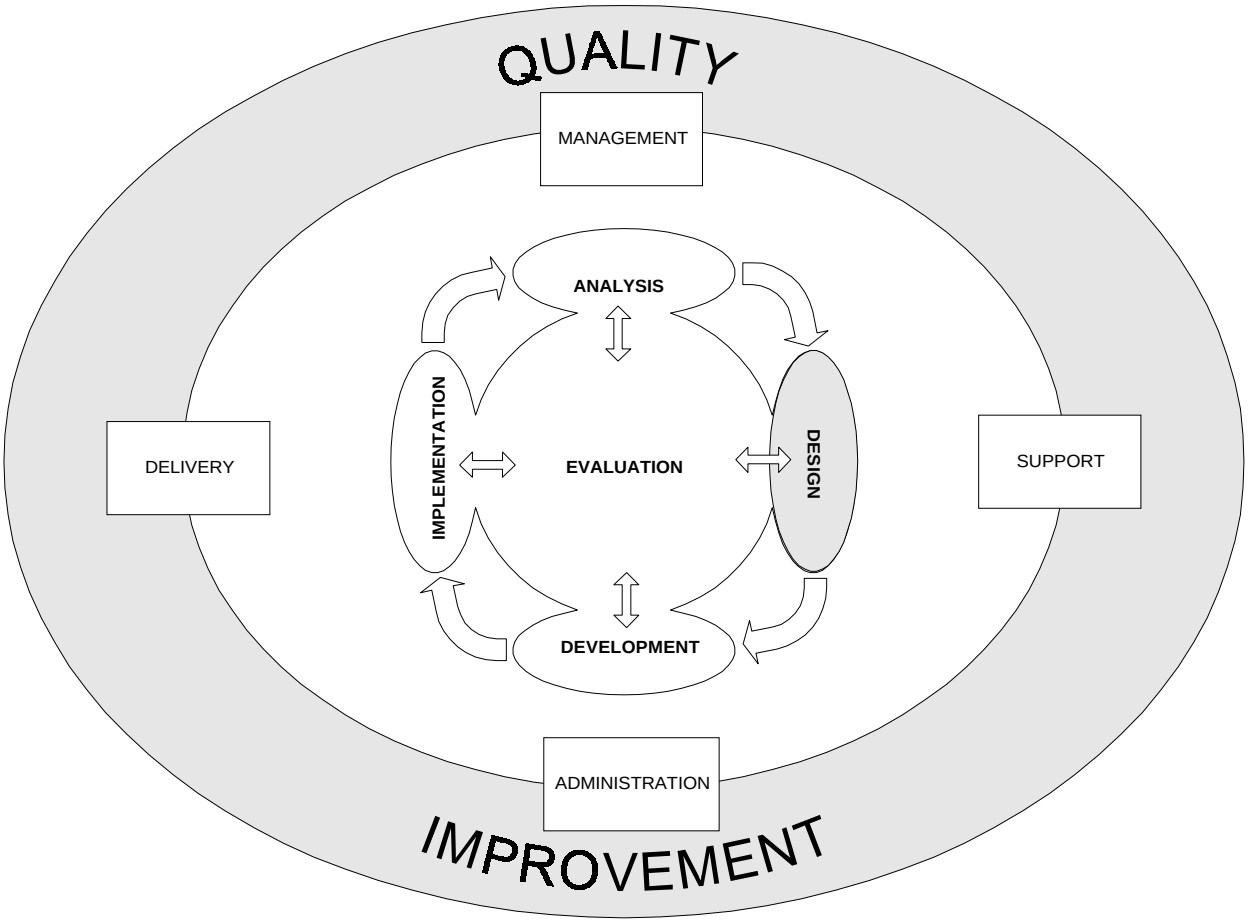

FIGURE 13. **ISD/SAT design phase.**

7.1.1 Design events. The following events are listed in a sequence that is only provided to aid in a better understanding of the design process. In practice, the events may be performed sequentially as presented in this handbook, some may be skipped, iteration among some events may be required, or a different sequence may be used. Various factors may affect the sequence or scope of the events used, such as Service needs, scope or complexity of the training project, or other factors. The events to be applied and their sequence should be documented in the specific project management plan. The events for the design phase are:

a. Develop LOs.
b. Categorize LOs by learning type.
c. Construct the learning analysis hierarchies.
d. Identify the student target population prerequisite requirements.
e. Review existing materials.
f. Develop test items.
g. Determine instructional strategies.

h. Select the instructional methods to be used.
i. Select instructional media.
j. Analyze resource requirements/constraints.
k. Design lessons.
l. Update ISD/SAT evaluation plan.
m. Update management strategies.

7.1.2 Design process flowchart. The design portion of training development is provided in Figure 14 as a quick reminder of the activities involved in the design process. Figure 14 provides a representative sequence of events. There are other sequences that would work equally as well.

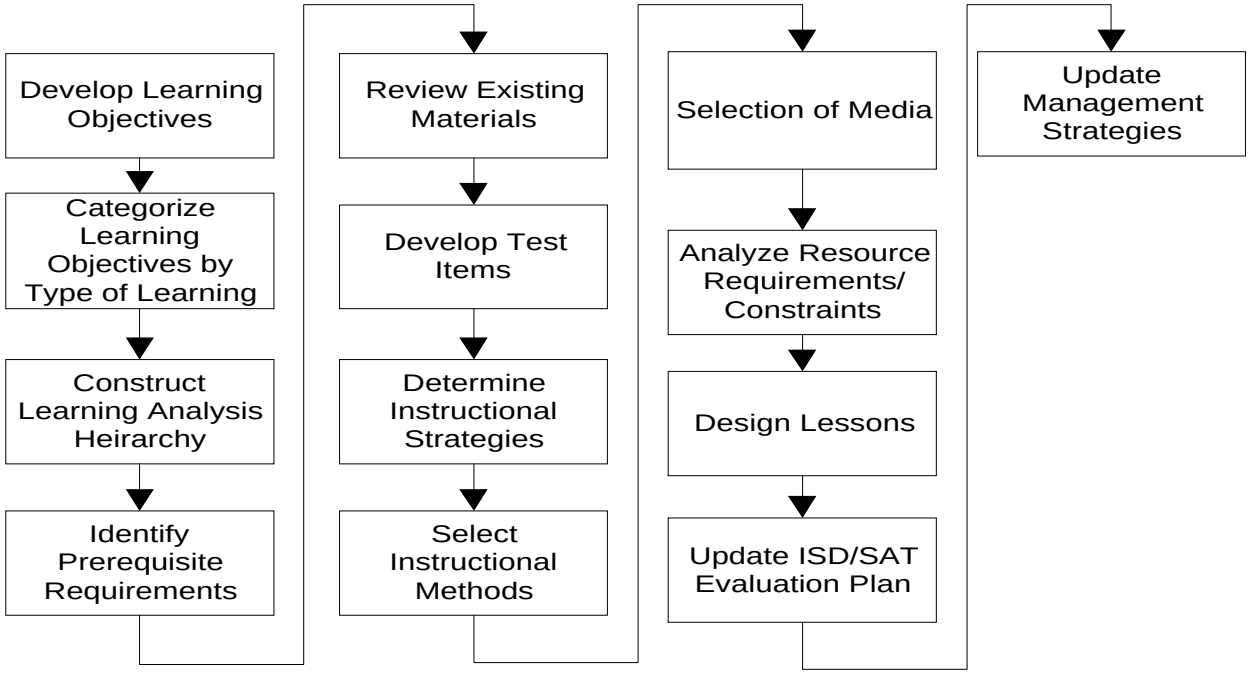

FIGURE 14. **Design process flowchart.**

7.2 Develop LOs. One product of the analysis phase is a list of tasks that require training. The list of tasks should be arranged in a hierarchy of skills with supporting knowledge and attitudes. In the design phase, use this task list and the task analysis to develop LOs for the course. LOs should be stated in terms of what the students must be able to do at the completion of training. Ensure that LOs are developed to fully support all the knowledge, skill, and attitude requirements between the students' entry-level baseline and the mastery level identified for the training program. A LO is a precise statement of the capability (KSA) a student is expected to demonstrate, the condition under which the KSA is to be exhibited, and the standard of acceptable performance. Some projects involve the development of new LOs with an existing task list. In this situation, a learning analysis should be conducted to ensure a complete list of KSAs. When a course is being converted, from traditional classroom instruction to an electronic

media format, it is essential to ensure the LOs and instructional strategies are developed to reflect the job task environment. The goal is to "train as you fight".

7.2.1 Purpose. LOs serve several purposes. Some examples are shown below:

a. For instructional developers, the LO will:

(1) Provide a basis for test item development.
(2) Allow for selection of the most appropriate training strategies.
(3) Structure events and activities to support learning.
(4) Supports final selection of appropriate and cost efficient methods and media.
(5) Supports sequencing of training.

b. For students, the LO will:

(1) Direct attention to the important content.
(2) Communicate standard of performance expected following the training.
(3) Serve as a self-check for progress.

7.2.2 Other terms for LOs. There are many terms used that mean the same thing as LOs. Regardless of what they are called, they are all LOs. The following terms are at times used to refer to LOs:

a. Performance objectives.
b. Behavioral objectives.
c. Instructional objectives.
d. Training objectives.
e. Criterion objectives.
f. Knowledge objectives.

7.2.3 Examples of LOs. Some examples of LOs are as follows:

a. Given the length of one side of a cube, compute the exact surface area.
b. Using a multimeter and schematic diagram, measure the resistance of a series circuit with no more than 5% error.

7.2.4 Characteristics of LOs. LOs have three parts 1) a behavior, 2) a condition, and 3) a standard. Before starting to develop LOs, become thoroughly familiar with each part of a LO. Familiarity with the different parts will enable the development of better LOs, and thus, better training. LOs should be worded carefully so that all readers or listeners have the same understanding.

7.2.4.1 Behavior. The behavior part of the LO states what a student will do to demonstrate that he/she learned a specific knowledge, skill, or attitude. A behavior is defined as a KSA that is observable and measurable. When stating the behavior in a LO, use action verbs to reduce ambiguity. Action verbs are observable and measurable while ambiguous verbs are not. Table 13 provides a job aid for the selection of action verbs for LOs. This table is organized in a taxonomy according to the type (i.e., knowledge, skill, and attitudes) and learning levels (i.e., fact learning, mechanism, and valuing). The use of standardized, well-defined verbs that provide clarity, will prevent duplicate work and aid in providing quality training. Standardized verbs allow analysts, developers, instructors, and students to understand precisely what the LO means.

7.2.4.1.1 Behavior statements. The behavior statement consists of an action verb, the object to be acted upon, and modifiers as necessary. Whenever possible, the verb should be selected from the Job Aid for Selecting Action Verbs in Table 13. The selection of the correct verb automatically identifies the appropriate learning type and learning level. The behavior must be written in measurable, observable terms so that student performance can be objectively evaluated. Learn to write the behavior part of a LO so that the tasks to be taught are clearly stated so that everyone (e.g., students, instructors, developers, etc.) knows exactly what must be learned by the students. The following are examples of behavior statements:

a. Compute the surface of the sphere to the second decimal point.
b. Calculate amount owed from the last fiscal quarter.
c. Measure the resistance of a series circuit.
d. Identify photographs of threat aircraft.
e. Disassemble an M-16 rifle.

7.2.4.2 Condition. A thorough understanding of the conditions will help to develop effective LOs. A condition identifies the situation under which a student is expected to demonstrate a behavior. A properly prepared LO clearly states the limits or conditions of student performance.

7.2.4.2.1 Things to consider. When determining the conditions for the LOs, consider that:

a. Conditions should specify the objects, events, human behavior, words, or symbols, which will be presented to the students.
b. Conditions under which the training is performed should be the same as the actual job conditions, if possible.
c. Conditions should be written with particular care to include, in sufficient detail, any safety, environmental, or Nuclear, Biological, Chemical (NBC) related conditions which apply to the action being developed into a LO.

7.2.4.2.2 Examples of conditions. Condition statements can normally be derived from the task analysis data. The following are some examples of conditions:

a. "Given the diameter of a sphere and the formula, . . ."
b. "Using a calculator and debit worksheet, . . ."
c. "Using a multimeter and schematic diagram, . . ."
d. "Without reference, . . ."
e. "Under conditions of total darkness, . . ."

7.2.4.3 Standard. The final part of a well prepared LO is a clearly stated standard of performance. The student's performance will result in an output, the quantity or quality of which is the standard of performance. If no standards were identified in the task analysis data that was previously collected, set standards based on other sources such as experience or similar tasks. A standard defines the criteria for acceptable performance by the student. It is stated in terms such as completeness, accuracy requirements, time constraints, performance rates, and qualitative requirements. It identifies the proficiency the students must achieve when they perform the behavior under the specified conditions. Without a standard, it is impossible to determine when the students have achieved the LO.

7.2.4.3.1 Types of standards. Standards can be classified as one of the following types described in Table 20.

TABLE 20. **Types of standards**.

TYPE OF STANDARD	EXAMPLES
Completeness	"……will comply with AFRs and local regulations."
Accuracy requirement	"……compute the exact surface area of the sphere."
Time constraints	"……minimum speed of 35 words per minute."
Performance rates	"……at a minimum of 20 units per day."
Qualitative requirements	"……to idle smoothly. . ."

7.2.5 Guidelines for developing LOs. The first thing needed in order to develop LOs is the list of tasks (task worksheet) that were developed during task analysis. Effective LOs can be developed by using the task list, a few guidelines, and what has been learned about LOs to this point. If the training task list has been developed in a hierarchical list of KSAs, including learning required to achieve them, a LO is developed for each. It is not necessary to conduct a learning analysis in the development of additional LOs. Guidelines for developing LOs are provided in Table 21.

TABLE 21. **Guidelines for developing LOs**.

TYPE	GUIDELINES
General	• Use task descriptions developed during the analysis phase. • Analyze each task on the task list to determine the number of LOs that are required. • Document each LO on a worksheet. • Use learning analysis results to assign knowledge and skills to support each LO and sub-objective. • Document results on worksheet.
Behavior	• Ensure that behavior is the same as that required on the job, if possible. • State the behavior in terms that everyone understands. • Use an action verb. • Do not use ambiguous verbs such as "know," "understand," etc. • Use behaviors that are: •• Observable. •• Measurable. •• Reliable. •• Verifiable against the task.
Condition	• Select conditions that match job conditions as closely as possible. • Ensure that conditions are realistic.
Standard	• Use a standard that meets job performance requirements, if possible. • Use a standard that is clear and understood by everyone. • Use a standard that accurately measures student achievement of the LO. • Ensure that the standard is complete. • Ensure that the standard is accurate. • Ensure that the standard is achievable.

7.3 Categorize LOs by learning type. Using Table 13, select the appropriate action verb, and use the table to identify the learning type associated with the LO, (KSA) and the learning level. If this step was conducted during task analysis, it should not be repeated here. This will aid the instructional analyst in determining the best methods and media to support instruction of the LOs. The identification of these categories will assist in writing the LOs and selecting appropriate events and activities to support learning. Table 13 is organized in a taxonomy according to the type (i.e., knowledge, skill, and attitudes) and learning levels (i.e., fact learning, mechanism, and valuing). The use of standardized, well-defined verbs that provide clarity, will prevent duplicate work, and aid in providing quality training. Standardized verbs allow analysts, developers, instructors, and students to understand precisely what the learning objective means. Except in unusual circumstances, a terminal or topic LO action verb should be the same as the action verb in the corresponding task or sub-task statement. For enabling objectives that are

developed to support a specific skill or knowledge requirement below the sub-task level, use the left column in Table 13 for selecting the LO action verb.

7.4 Construct learning analysis hierarchies. Whether the learning analysis is conducted on tasks or LOs, the development of the LO KSA hierarchy is the same. Most tasks are made up of subtasks. Students need to learn each of these subtasks before they can perform a particular task. In other words, LOs for those subtasks need to be specified. Different levels of LOs can be structured into a LO map that depicts the relationship of various LOs and their sequence. This map is called LO or learning hierarchy. Many terms have been used to describe the LO hierarchies. This handbook will refer to the different levels only in order to show the hierarchical relationship of LOs. The hierarchical levels are established by the learning types (i.e., knowledge, skill, and attitude) and their corresponding learning levels. The learning analysis hierarchy should have been developed for tasks and sub-tasks. Additional LOs should be integrated into the task learning hierarchy.

7.4.1 Purpose. The purpose of the LO hierarchy is to depict the relationship of LOs so that the most effective and efficient learning sequence can be developed.

7.4.2 Classification of LOs. LOs can be classified into two categories, as shown in Table 22. The action verb list (see Table 13) also contains a complete list of learning types and levels that will aid in determining that all Enabling LOs (ELOs) required to support a Terminal Learning Objective (TLO) have been identified.

TABLE 22. **Classification of LOs**.

CATEGORY	DESCRIPTION	OTHER NAMES
TLO	A LO at the highest learning level (KSA) appropriate to the human performance requirements a student will accomplish when successfully completing instruction.	• Primary. • Main. • End. • Course.
ELO	A LO that students must attain in order to accomplish a terminal objective.	• Secondary. • Supporting. • Subordinate. • Topic.

7.4.3 Example of LO hierarchy. Figure 15 is an example of a LO hierarchy. "Maintain F-16 Fuel System" is the TLO and the others are ELOs.

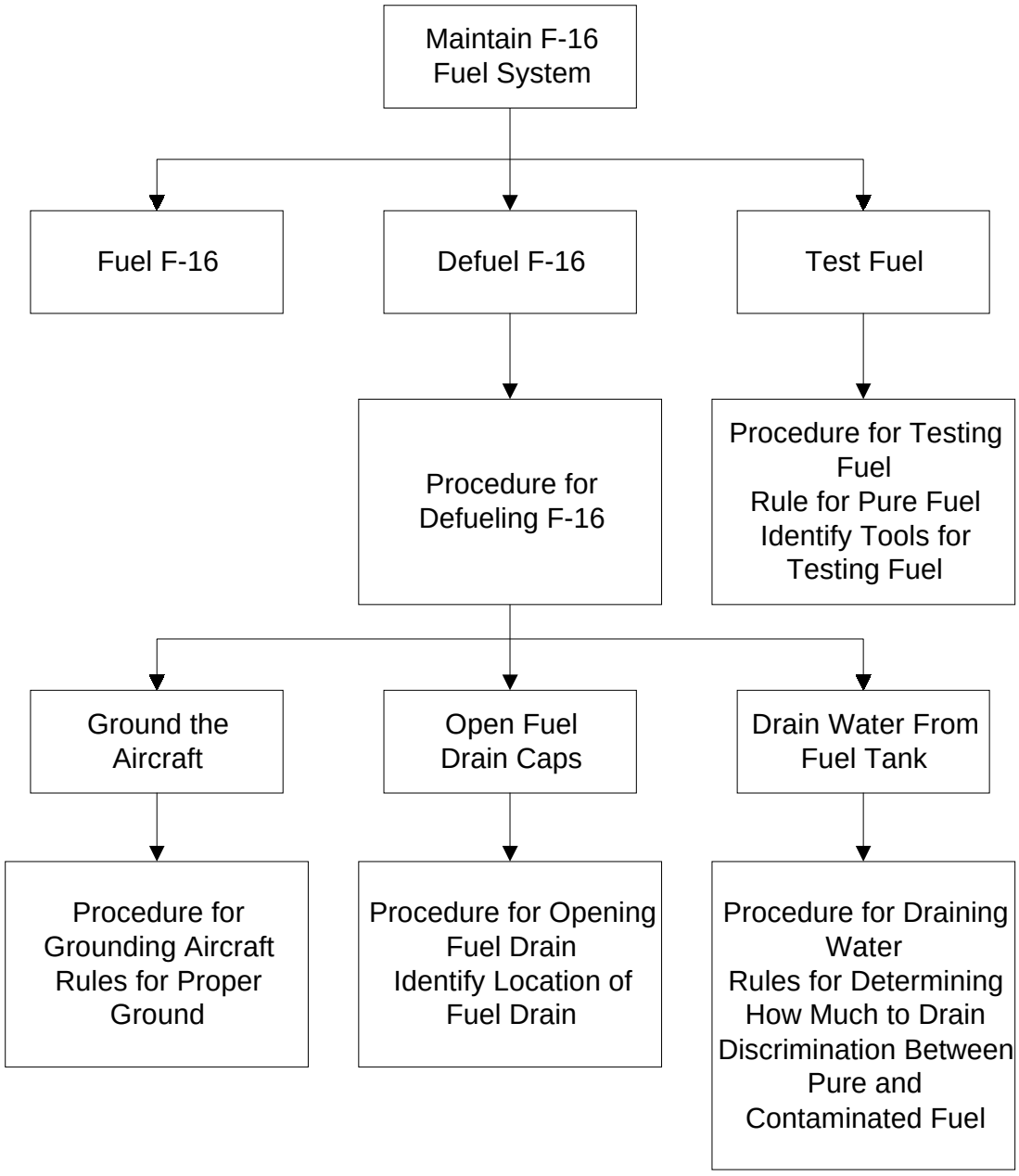

FIGURE 15. **Example of a learning objective hierarchy.**

7.4.4 Prioritizing, clustering, and sequencing LOs. The effectiveness and cost-efficiency of a course will depend in part on how well the LOs are prioritized, clustered, and sequenced.

Guidelines for prioritizing, clustering, and sequencing LOs will be provided in the following paragraphs.

7.4.4.1 Prioritize LOs. Prioritizing LOs may not be required in all training projects. However, as budgets continue to shrink, it may be necessary to prioritize the LOs in order to provide the training that is most needed by the users. For example, a 25-day course is required to teach a particular set of LOs. Due to student allocation constraints, it is only allowable to develop a course that is 20 days in length. To reduce the course length by five days, it is necessary to determine which LOs are less critical and can be eliminated from the course.

7.4.4.2 Clustering LOs. The purpose of clustering or grouping LOs is to develop logical and meaningful portions of training such as units, lessons, or segments. When clustering LOs, use the following guidelines:

a. Cluster LOs that are common prerequisites to other LOs. For example, basic electronic knowledge and skills may be required for many tasks in a course; therefore, they may be clustered in the same unit and taught in the core training.
b. Cluster LOs that are related to the same system or require the same type of action. For example, all tasks related to the maintenance of a particular piece of navigation equipment may be clustered into a unit.
c. Cluster LOs with common knowledge and skills. For example, some maintenance tasks require identical knowledge and skills across different systems, such as computer maintenance or aircraft refueling.
d. Cluster LOs by learning type. For example, cluster knowledge LOs utilizing the lecture method, and cluster skill LOs taught by demonstration/performance method. Clustering LOs with the same learning type will often promote the efficient structure of a course.

7.4.4.3 Sequencing of LOs. A goal of good instructional design is to establish sequences within courses that promote effective learning. There are several sequencing techniques that can be applied. Sequence the course to minimize risks. For example, a lesson that requires the use of complicated, dangerous equipment should not immediately follow a three-day exercise that allows personnel little opportunity for sleep. Risk assessment is a consideration, no matter which technique for sequencing is used. The following are techniques for sequencing:

a. Job performance order. TLOs, ELOs, and learning steps are sequenced in the same order in which they are performed. The learning sequence and job performance sequence are the same. This technique is appropriate for actions that must be accomplished in a prescribed order such as assembly and disassembly of a weapon or loading a tank's main gun.
b. Chronological order. The instruction flows from topic to topic, retaining the order and time in which events occur. This technique is appropriate for actions that follow a

specified order related to time (e.g., planning the timed events of a military campaign, etc.).

c. Cause and effect order. Actions are sequenced to demonstrate cause and effect relationships. This technique is appropriate for relationships that personnel must commit to long term memory and for which training environment performance failures can be tolerated.
d. Critical order. Actions are sequenced in the order of relative importance, whether from the least important to the most important or vice versa, depending on the situation. Tasks favoring this technique are those that require an important action such as "Clear weapon before starting disassembly".
e. Simple-to-complex order. Actions are sequenced in terms of increasing complexity, each one building on the prior action. Appropriate tasks for this technique are those that require performing a simple task in order to master complex tasks.
f. Complex-to-simple order. Actions are sequenced in terms of decreasing complexity, each associated with the larger complex structure of which it is a part. Appropriate tasks for this technique are those that require understanding the existence of a complex structure in order to give meaning to the mastering of the simpler actions supporting it.
g. Known-to-unknown order. Familiar topics are considered before unfamiliar ones. This technique is appropriate in situations where the target audience has some familiarity with the type of action, but the specific action is generally unknown to them. For example, maintenance of military commercial vehicles would precede maintenance of lesser-known military specific vehicles.

7.4.4.3.1 Relationships in sequencing. In order to logically sequence actions, the training developer must determine the relationship among them. The four most important relationships in sequencing are 1) dependent, 2) supportive, 3) independent, and 4) conflicting. They are described in detail below:

a. Dependent relationships exist between actions that are prerequisite to other actions. Personnel must master the dependent action before they can master the other(s). Examples of actions having a dependent relationship are:

   (1) To learn to "Identify a saddle" as a topographic feature on a map, one must first learn to "Identify contour lines" as the brown lines on a map.
   (2) To learn to "Send a message in Morse Code", one must first learn to "Identify the Morse Code symbols for each letter and number".

b. Supportive relationships exist between actions that have some relationship to actions in other LO(s). The learning acquired during mastery of an action transfers to the other(s), making mastery of the other(s) easier. Place supporting actions as close together as practical so that maximum transfer of learning takes place. Examples of actions having a supportive relationship are:

(1) "Assemble the M16" has a supportive relationship to "Assemble the M60".
(2) "Drive a ¼-ton truck" has a supportive relationship to "Drive a 2 ½-ton truck".

c. Independent relationships exist between actions that are unrelated to those in other LOs. Mastering one independent action does not simplify learning the other(s). Arrange actions having independent relationships in any reasonable sequence. However, they should not be placed between actions having a dependent or supporting relationship. Examples of actions having an independent relationship are:

(1) "Type letters from drafts" is independent of "Maintain personnel records".
(2) "Assemble the M16" is independent of "Drive a ¼-ton truck".

d. Conflicting relationships exist between actions that involve opposite responses to the same cue in a different context. These responses must be clearly related to the situation in which the cue is received. The two actions should be taught together and the reason for the opposite response to the same cue explained and reinforced. The conflicting element that causes two very similarly stated LOs to be conflicting usually involves a visual or auditory cue within the LOs. Examples of conflicting elements present in similarly stated actions are:

(1) In the action "Operate radio in the secure mode", different tones were used in similar radios manufactured by different companies to cue an operator that the radio is operating in the secure mode. Operators had to be trained to associate the meaning of the tone to the specific model of radio in use.
(2) In the action "Engage targets with Stinger missile", the more sophisticated electronics available in the Setter mounted Stinger guided the operator to adjust the sight picture to respond to false reflected Infrared (IR) signals from clouds. Operators attempted to make the same adjustments to similar sight pictures when using the Stinger in its manportable configuration. The electronics in the manportable Stinger do not identify the IR reflective qualities of clouds in the manner that the Setter does. Operators had to be taught that they should not make the sight picture adjustment when using the manportable Stinger.

e. Not all actions fit neatly into one of the above categories. Some may seem to be both dependent and supportive. Other combinations may seem to be just as possible. The two things to remember are to have a justification for the sequence and that in some cases the sequence can be changed. Sequencing decisions need to be documented to provide an audit trail. Table 23 summarizes the relationships between LOs.

TABLE 23. **Types of relationships among LOs**.

TYPES OF RELATIONSHIPS BETWEEN LOs.			
DEPENDENT	**CONFLICTING**	**SUPPORTIVE**	**INDEPENDENT**
Knowledge and skills in one LO are closely related to those in the other LO.	Knowledge and skills in one LO conflict in some respect with those in another LO.	Knowledge and skills in one LO have some relationship to those in the other LO.	Knowledge and skills in one LO are unrelated to those in the other LO.
To master one of the LOs, it is first necessary to master the other.	Mastering one LO may cause difficulty in mastering the other LO.	Mastering one LO transfers to other, making learning involved in the mastery of the other easier.	Mastering one LO does not simplify mastering the other.
LOs must be arranged in the sequence indicated by the knowledge and skills hierarchy.	LOs must be taught closely together, directly addressing the conflicting elements between the two LOs.	LOs should be placed close together in the sequence to permit optimum transfer of learning from one LO to the other.	In general, the LOs can be arranged in any sequence without loss of learning efficiency.

7.5 Identify student target population prerequisite requirements. After the LOs have been categorized into appropriate learning types, identify the prerequisite requirements as follows:

a. Identify the level of knowledge and skills required of students upon entering the training program.
b. Determine the baseline of knowledge and skills pertinent to the training requirement which the student has acquired in previous civilian education, military training, or experience.

7.6 Review existing materials. Developing training materials can be expensive and time-consuming. Therefore, after developing LOs and test items, review existing training materials to determine if materials exist that will support course LOs. If materials are found, it is possible that they will not totally support the LOs. If so, modify the material to fit the need. Using existing materials saves development time, human resources, materials, and money.

7.6.1 Sources of existing materials. Existing training materials may be obtained from:

a. DoD.
b. Other Services.
c. Other federal agencies.
d. Commercial/industrial organizations.
e. Colleges and universities.

7.6.2 Types of existing materials. Existing training materials may be found in one of the following forms:

a. Printed materials (e.g., textbooks, publications, technical orders, job aids, etc.).
b. Visual information (e.g., slides, videos, etc.).
c. Audio cassettes.
d. Computer based (e.g., ICW, Computer-Aided Instruction (CAI), etc.).
e Training aids.

7.6.3 How to select materials. To standardize the process and allow comparison between materials under review, the job aid provided in Table 24 may be useful when selecting existing materials.

TABLE 24. **Job aid for review and evaluation of existing materials**.

EXISTING MATERIAL REVIEW AND EVALUATION FORM					
Evaluator:	Date:				
1. Learning objectives the material supports are:					
2. Type of media:					
3. Evaluation of material	Poor				Good
	1	2	3	4	5
a. Content					
(1) How well do test items measure the LOs?					
(2) How appropriate is the vocabulary level of the material?					
(3) How accurate are the procedures?					
(4) How accurate is the visual information?					
(5) How comprehensible is the visual information?					
(6) Rate the currency of the material.					
(7) How appropriate are the instructional activities for the job task?					
(8) How well does the material provide instructional					
(9) Rate the sufficiency of practice exercises?					
b. Structure					
(1) How well is the material organized?					
(2) Rate the sequence of the instructional material?					
(3) How appropriate is the instructional strategy for the job task?					
c. Suitability					
(1) How well does the material support the LO(s)?					
(2) How user-friendly is the material?					
(3) Rate the pace of the instructional material.					
(4) How well does the material provide for student feedback?					
(5) How well does the material motivate the student?					
(6) How appropriate is the use of proprietary or copyrighted material.					
(7) How well do the tests measure mastery of the student's KSAs?.					

7.6.4 Modifying existing materials. Sometimes existing materials are available for use but they require modification. If existing materials cannot be found that fit the needs, proceed to design unique training. The design determines the effectiveness and cost-efficiency of the instructional system. Design should be determined by what best meets the training needs. When modifying existing materials, it is possible to:

a. Add new materials such as information on the operation of a particular piece of equipment that was not covered in the existing material.
b. Expand existing materials to include information that is more detailed such as, diagrams, illustrations, and examples.
c. Delete materials that do not support the LO(s).
d. Update material to include the most current information such as revised procedures and data, and to correct inaccuracies.
e. Re-sequence material to make it compatible with the design of the instructional system.

7.7 Develop test items. After specifying the LOs for the course, the next task is to develop test items. The primary purpose of test items is to assess the student's attainment of the LOs. To ensure that test items adequately measure the LOs, the performance required in the test item should match the performance required in the LO (including learning type and learning level). Test items should be developed immediately after the LOs have been written.

7.7.1 Multiple choice test items. Although multiple choice test items are not a good predictor of transfer of learning to the job environment, they are probably the most used type of written test item. They test recall of facts and application of rules and procedures. Multiple choice may also be used to test discriminations and problem solving. A multiple choice test item consists of a stem (a question or uncompleted statement), a correct response, and distracters (incorrect responses). The following is an example of a multiple choice test item:

"Directions: Carefully read the questions or statements below and circle the correct response. There is only one correct response.

1. Hydraulic systems using mineral base fluids are flushed and cleaned with:

a. Alcohol.
b. Kerosene.
c. Soap solution.
d. Carbon tetrachloride."

7.7.1.1 Construction guidelines. The following are guidelines for writing multiple choice test items:

a. Do not use the articles "a" and "an" at the end of the stem; this tends to indicate the correct answer.
b. All responses should follow grammatically from the stem.
c. All responses should be of approximately the same length.
d. All responses should have a similar grammatical structure.
e. All responses should use similar terminology.
f. Provide as many responses as necessary but normally four.
g. Position the correct response randomly throughout the test.
h. Limit the use of responses such as "none of the above" or "all of the above."
i. Ensure that there is only one correct answer.
j. Distracters should be plausible but incorrect.
k. If the distracters are numerical, list them in ascending order.

7.7.2 Multiple/multiple choice test items. Multiple/multiple choice questions are used when there are multiple correct responses possible. A broad scope of information can be covered within a single question, thus increasing the complexity and difficulty of the question. The following is an example of a multiple/multiple choice test item:

"Directions: For question 8, SELECT:

a. if only 1, 2, and 3 are correct.
b. if only 1 and 3 are correct.
c. if only 2 and 4 are correct.
d. if only 4 is correct.
e. if all four are correct.

Which of the following possess(es) a clearly established relationship as a risk factor for coronary artery disease?

1. High stress.
2. Tobacco use.
3. Alcohol use.
4. Hypertension."

7.7.2.1 Construction guidelines. The following are guidelines for developing multiple/multiple choice test items:

a. Group all of the questions of this type together on a test so directions can be given once for several questions.
b. Provide clear directions on the choosing of the correct answer.
c. Use singular/plural verbs in stem to prevent grammatical cues to the correct response.
d. Use direct questions that end with question marks.

e. Use four responses.

7.7.3 True/false test items. Multiple true/false test items should be written for each concept since the chance of random guessing is high. True/false test items may be used when a student is to identify a completely true or completely false statement. True/false test items may be used to test recall of facts, rules, and procedures. The following are examples of true/false test items:

"Directions: Carefully read the questions below and circle true or false to indicate the correct response.

True/False	1.	When cleaning solvents are being used, it is extremely important to provide adequate ventilation.
True/False	2.	A good mechanical connection helps ensure a good electrical connection."

7.7.3.1 Construction guidelines. The following are guidelines for true false test items:

a. Include only one idea in each statement.
b. Place the crucial element at or near the end of the statement.
c. Avoid using negatives such as "no" or "not." They tend to confuse students.
d. Do not use absolutes such as "all," "every," "none," and "never."
e. Do not use statements containing "some," "any," and "generally."

7.7.4 Matching test items. A matching test item is used to measure a student's ability to recognize facts and discriminate among related or similar items. Matching test items normally use two columns of related items, and students are required to match a series of items listed in one column with related items in the other column. It provides a way to test various knowledge factors simultaneously. Table 25 is an example of a matching test item:

TABLE 25. **Matching test item example**.

"Directions: Listed in the two columns below are words and phrases. Select the phrase in the right-hand column that defines the word in the left-hand column and place the identifying letter in the blank space provided. Some of the phrases may be used more than one time, while others may not be used at all. The first item is answered as an example.	
_C_ Validity	a. Detects small differences in the mastery of the subject matter.
___ Reliability	b. Determines the ease of administering, scoring, and interpreting test results.
___ Objectivity	c. Measures what it is designed to measure.
___ Comprehensiveness	d. Includes a proportional number of test items on all lesson objectives.
___ Differentiation	e. Yields consistent results every time it is given.
___ Usability	f. Is often determined by correlating the original test scores with those obtained in a retest.
	g. Yields test scores that are not influenced by bias or personal opinion of the score.
	h. Is assumed to be present when a job is learned to a high level of proficiency within a reasonable time."

7.7.4.1 Construction guidelines. Guidelines for creating matching test items are as follows:

a. Provide clear, concise directions on how to match the items in the two columns.
b. Indicate whether the responses may be used more than once.
c. Limit test items to a single area and choices to a single subject category.
d. Arrange the responses in the same logical order.

7.7.5 Completion test items. A completion test item requires the student to recall facts and supply one or more key words that have been omitted from the statement. When placed in the appropriate blanks, the word(s) make the statement complete, meaningful, and true. The following is an example of completion test items:

"Directions: Complete the sentences below by adding the correct word(s) in the blank spaces provided.

1. Good _____ connections help to ensure a good _____ connection.

2. A test item consisting of a sentence or statement from which a word or phrase is omitted is called _____."

7.7.5.1 Construction guidelines. Guidelines for creating completion type test items are

provided below.

a. Leave blanks for key words only.
b. Keep items brief.
c. Make all blanks approximately the same size.
d. Grammatical cues to the correct answer, such as the articles "a" and "an" just before the blank, should be avoided.
e. Ensure that only one correct answer is possible for each blank.
f. Ensure that the sentence has enough context to cue the correct response.

7.7.6 Labeling test items. Labeling or identification test items are used to measure a student's ability to recall facts and label parts in pictures, schematics, diagrams, or drawings. This form of test item is most often used to measure recognition of equipment components or other concrete objects. An example of a labeling test item is provided in Figure 16.

“Directions: Identify the numbered items of a desktop computer. Place the correct answer in the space provided.”

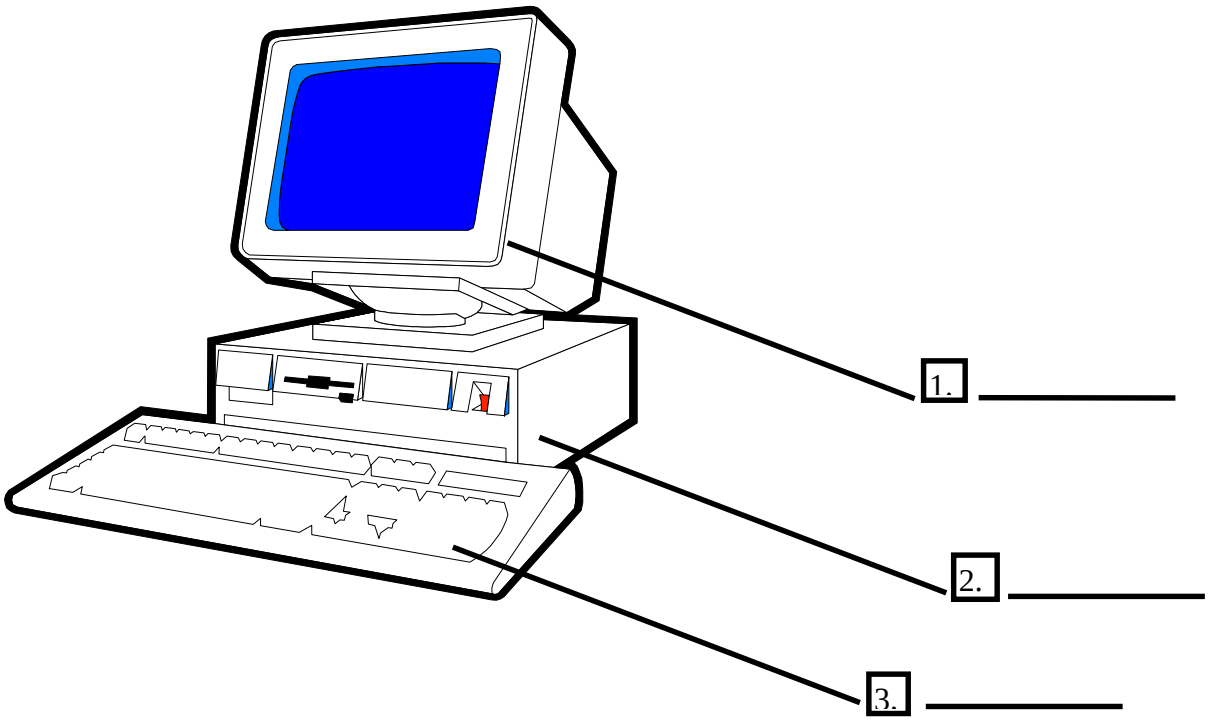

FIGURE 16. **Example of a labeling test item**.

7.7.6.1 Construction guidelines. Guidelines for constructing labeling type test items are provided below.

a. Make all sketches, drawings or illustrations clear and of sufficient size. If possible, use the actual parts of a unit.
b. Provide sufficient information to indicate what the equipment is and which part is to be labeled.
c. The parts to be labeled or identified should be clearly pointed out by using lines or arrows.
d. Ensure that only one definite answer is possible.

7.7.7 Essay test item. An essay test item requires a more or less extensive discussion by the student. It should be used only when the students are expected to recall facts, apply rules and procedures, and think reflectively or creatively, to organize knowledge in the solution of a problem, and to express their solution in writing. The following is an example of an essay test item:

"Direction: Complete the essay question in 500 words or less. Use only one side of the paper to write your response.

Test Item: Describe how the ISD/SAT process applies to development of technical training."

Caution – Essays are susceptible to incorrect scoring. Be sure to evaluate the assigned essay action (e.g., compare, contrast, describe, etc.). The student should not be penalized for omitting facts not required by the theme.

7.7.7.1 Construction guidelines. Guidelines for constructing essay type test items are provided below.

a. State the essay test item clearly so the student knows exactly what type of discussion is expected.
b. The essay test item should ask for comparisons, decisions, solutions, cause-effect relationships, explanations, or summary.
c. When possible, use more essay test items and limit the discussion on each.
d. Set limits on essay test items such as time or number of words.

7.7.8 Cognitive processing test items. Cognitive processing test items are used to measure the knowledge of a subject. Knowledge at each of the learning levels (e.g., fact, rules, procedures, discriminations, and problem solving, etc.) may be required in order to successfully perform the skill. Understanding the knowledge learning levels is required for precise evaluation. The following are used to evaluate cognitive processing:

a. Determine whether the student is using two or more facts in a manner that provides regularity of behavior in an infinite variation of situations.
b. Determine whether the student is performing mental step-by-step processes in the proper sequence.
c. Determine whether the student is grouping similar and dissimilar items according to their distinct characteristics.

7.7.8.1 Construction guidelines. Guidelines for constructing cognitive processing type test items are as follows:

a. Require the student to describe mental steps, cues, and choices.
b. Require the student to describe mental actions during performance.
c. Intelligent program with processes embedded.

7.7.9 Performance test items. Performance test items are used to measure knowledge of a subject as well as the ability to perform the skills. Knowledge at each of the learning levels (e.g., fact, rules, procedures, discriminations, and problem solving) may be required to successfully perform the skill. Perception, gross motor, continuous movement, and readiness may all be required to achieve performance at the mechanism level. Understanding each learning level for both knowledge and skill types is required for precise evaluation of a performance and pinpointing error. When developing performance test items, use the following steps:

a. List steps/activities/behaviors (process) or characteristics (product).
b. Note common errors that are made when using the checklist.
c. Arrange the activities or steps and characteristics in correct order.
d. Review the checklist for accuracy and completeness.

7.7.9.1 Constructing performance test items/checklist. Performance test items, which require the student to perform a task, usually have the format of a checklist. The checklist is developed to correspond to the steps or activities of the task being performed and the underlying knowledge and skill elements. This may help identify precisely what occurred during performance. During the performance test, an evaluator observes the student performing a series of steps or activities while rating the steps on a checklist (process evaluation). An evaluator may also rate the end product of a performance on a checklist (product evaluation).

7.7.9.1.1 Performance test items using a process checklist. When a performance test requires the steps or activities to be rated, a process checklist is used. The process checklist should contain all of the essential steps or activities required for successful performance. An example is provided in Table 26.

TABLE 26. **Process checklist: Install resistor on circuit board**.

CHECK	STEP OR ACTIVITY	DESCRIPTION OF ERROR
	1. Prepare the soldering iron. a. Select the correct tip. b. Identify the characteristics of tips. c. Procedure for installing tip. d. Rule for tip selection. e. Identify the different tips.	
	2. Mount the circuit board in the jig. a. Procedure for mounting. b. Rule for jig configuration. c. Identify the different jigs.	
	3. Select the proper resistor. a. Rule for resister selection. b. Characteristics of resistors. c. Identify different resistors.	
	4. Install resistor on circuit board.	
	5. Solder resistor leads. a. Procedure for soldering. b. Rules for soldering. c. Identification of leads.	

7.7.9.1.2 Process checklist construction guidelines. Construct a process checklist for performance tests using the following guidelines:

a. Use when the performance of steps or activities of a task is to be evaluated.
b. The steps or activities must be observable.
c. Define all of the steps or activities of the task being performed.
d. Sequence steps or activities in order of performance.
e. Provide space for "checking" the performance of each step or activity.
f. Provide space for recording and describing errors.

7.7.9.1.3 Performance test item using a product checklist. When a performance test item requires the product of a process or task to be evaluated, it will be beneficial to use a product checklist. The product checklist should identify criteria or characteristics of product acceptability. An example is provided in Table 27.

TABLE 27. **Product checklist: Install resistor on circuit board**.

YES	NO	PRODUCT CRITERIA/CHARACTERISTICS	COMMENTS
		1. Is the value of the resistor correct?	
		2. Is the resistor correctly mounted on the circuit board?	
		3. Is the soldering iron properly tinned?	

7.7.9.1.4 Product checklist construction guidelines. Construct a product checklist for performance test items using the following guidelines:

a. Use checklist when the LO requires the student to produce a product.
b. Use checklist when the product can be readily evaluated.
c. Use checklist when there are no fixed or set procedures.
d. Identify the characteristics of the product.
e. Provide space on the checklist for product rating.
f. Provide space on the checklist for comments about the product.

7.8 Determine instructional strategies. After the LOs and related test items have been developed, plan and develop the most effective and cost-efficient learning environment using the principles of learning. This process starts by determining the instructional strategies or plan to be used. An instructional strategy is necessary in order to manage the design of the training activities and the learning process. A critical factor to consider when selecting an instructional strategy is compliance with the DoD policy on ADL. The goal of the ADL policy is to leverage computer, information, and communication technologies through the use of common standards to provide learning that can be tailored to individual needs and delivered on demand, anytime anywhere. Selection of the instructional strategy needs to be consistent with the prior LOs hierarchy decisions. It also needs to support the instructional goals and overall instructional concept. In most cases, the instructional strategy should reflect the job task environment.

7.8.1 Strategy for student participation. Active student participation is essential for learning to take place. Students learn by doing, thinking, and feeling - through answering questions, discussing, computing, manipulating, and putting ideas together. The instructional strategy ensures that students are active in the learning process and can apply or demonstrate what they have learned. Learning is a process in which students gain knowledge and skills, and shape attitudes through their own activities, experiences, and motivations. For each learning type, consider using the following strategies.

a. Knowledge:

(1) Provide drill and practice to reinforce recall.
(2) Use examples and non-examples to reinforce understanding.

(3) Provide opportunity to practice the knowledge in context.
(4) Utilize discovery, collaboration, inductive, deductive, and conferencing.

b. Skill:

(1) Demonstrate task that the student is to perform.
(2) Have each student do each step of the task following the demonstration.
(3) Have each student perform the entire task with minimum guidance.

c. Attitude:

(1) Use human modeling to shape student attitude.
(2) Use guided discussions for affective lessons.
(3) Give or withhold rewards.

7.8.2 Student feedback strategies. Students participating in the instructional/learner activities will need feedback on how well they are performing. Feedback not only informs the students on how well they are performing, but also serves as a valuable source of motivation. The instructional strategy should provide each student with feedback, whether it is the results of a written test or instructor comments during the performance of a task. The instructor should ask frequent questions and provide feedback to address any possible misunderstanding the student may have about the content.

7.8.3 Student pacing strategies. Pacing is the rate at which students go through the training. There are several ways to pace students' progress.

a. Self-paced. Students are allowed to work at their own pace (i.e., asynchronously) through the training within certain parameters. This form of pacing is very effective in courses using Computer Based Training (CBT), interactive video, and self-study.
b. Group-paced. Students progress through the training together as a group, (i.e., synchronously) at the same rate. This is a very effective pacing method when training large numbers of students. However, it does not allow individuals to deviate from the group rate.
c. Group lock-step. The group progresses through the training at a predetermined pace, completing training on schedule. Normally, this is the most costly form of pacing. However, in cases where the group's pace through the training is critical, it is very effective.
d. Combination pacing. Any of the above-mentioned forms of pacing may be used in combination. This is an effective pacing method when various instructional strategies are used.

7.8.4 Instructional sequence. Instructional sequence is the route a student takes to achieve

the goal of an instructional unit and may include the entry point. The following are considerations for instructional sequencing when determining instructional strategies:

a. Proficiency advancement. This technique is used to advance students who have prior knowledge, practical experience, or are exceptionally fast learners. Students show their proficiency by passing a criterion test. Students may bypass the training in which they have passed the criterion test.
b. Multiple track. A training sequence may be divided into various tracks to allow students to go through training that is best suited to their abilities and needs. The best track for a student is determined by a pre-test.
c. Modular scheduling. Training is divided into different modules and students are pre-tested to determine which modules of training they need. Modular scheduling is normally used only when the learning sequence is not critical.

7.9 Select instructional methods. One of the most important tasks to be performed by the instructional developer or a member of a design team is that of selecting the instructional method. The method selected will have a direct impact on both the quality of the training system and its cost-effectiveness. The method should be based on the instructional concept and the course and lesson strategies. The instructional concept is established for the entire platform, organization, or weapon system. The instructional concept defines the schoolhouse and field training throughout the life of the system. Course strategies implement the instructional concept. Lesson strategies are specific applications of the strategies, often designed to provide training relevant to the operational job setting.

7.9.1 Instructional method. The instructional method is a component of the instructional strategy. It is the process used to deliver the training content and to provide guidance for students to retain the knowledge and skills imparted. Once the instructional developer or design team has designed the training activities, use the information to select the best training method(s) to achieve the LO. There are many instructional methods that can be selected. Some options are outlined as follows:

a. Presentation methods include:

(1) Lecture. A formal or semiformal oral presentation of information by a single individual; facts, concepts, problems, relationships, rules, or principles presented orally either directly (as by classroom instructor) or indirectly (as by audio/videotape or film).
(2) Demonstration. Presentation or portrayal of a sequence of events to show a procedure, technique, or operation. A demonstration frequently combines an oral explanation with the operation or handling of systems equipment or material. May be presented directly (as by a classroom instructor) or indirectly (as by video and film).

(3) Exhibit. A visual or print display used to present information; for example, actual equipment, models, mockups, graphic materials, displays, chalkboard, or projected images.
(4) Indirect discourse. Verbal interaction among two or more individuals which is heard by the student; may be a dramatization, such as role playing, or a dialogue between panel members, or a teaching interview (a question and answer session between instructor and visiting expert).
(5) Assigned reading. Printed materials such as books, periodicals, manuals, or handouts. Reading may be course-assigned or instructor assignments.

b. Student interaction methods include:

(1) Questioning. An instructor and/or courseware controlled interactive process used to emphasize a point, stimulate thinking, keep students alert, check understanding, or review material. Questioning may be direct, as by a classroom instructor, or may be designed into a film, computer based, or television presentation.
(2) Programmed questioning. An instructor and/or courseware controlled interactive process used to systematically demand a sequence of appropriate student responses; may be used directly (as by an instructor in a classroom) or indirectly (as by programmed booklets or computers).
(3) Student questioning. The provision by which students are given the opportunity to search for information, as by questioning a classroom instructor, tutor, coach, or an appropriately programmed computer.
(4) Seminar. A peer-controlled group interactive process in which task or LO related information and experience are evoked from the students. Questions may be used to evoke student contributions, but the seminar is distinguished from questioning.
(5) Discussion. An instructor-controlled interactive process of sharing information and experiences related to achieving a LO.

c. Knowledge application methods include:

(1) Performance. Student interactions with things, data, or persons, as is necessary to attain LOs; includes all forms of simulation (e.g., games and interaction with hardware simulators, etc.) and interaction with actual equipment or job materials (e.g., forms, etc.). Performance may be supervised by classroom instructor, tutor, coach, or peer to provide needed feedback.
(2) Case study. A carefully designed description of a problem situation, written specifically to provoke systematic analysis and discussion.

7.9.2 Selection considerations. There are several factors that should be considered when selecting the appropriate instructional method. These factors can be categorized into three major areas 1) constraints, 2) cost-efficiency, and 3) training considerations. Within these three

categories the following constraints should be considered:

a. Constraints include:

(1) Geographical spread of target audience. If the target audience is widely spread it may not be feasible to bring students to a central location for training. In this case, classroom training may not be the appropriate training method. Consider other instructional settings and media such as ADL, OJT, self-study, etc.
(2) Availability of students. If there will be an insufficient flow of students due to lack of travel funds, number of students to be trained, or other reasons, it is not likely that formal classroom training is appropriate. Also, student schedules may prevent group meetings. Again, a better method may be OJT or self-study. Consider using IMI or ADL if there are large numbers of students to be trained over a long period.
(3) Availability of instructors. If instructors are not available, consider other media such as self-study or ADL.
(4) Availability of facilities and equipment. If there is a lack of adequate facilities and equipment to handle the student flow, consider OJT, self-study, ICW, ADL, and others.
(5) Development time. Instructional media such as IMI require considerable development time. If development time is limited or only a few students are to be trained, consider other training methods such as self-study, OJT, and others.
(6) ADL considerations include availability of funds for bandwidth, number of students to participate, student equipment, time differential (if course is to be group-paced), firewall issues.

b. Cost-efficiency considerations include:

(1) Student throughput requirements. Expensive delivery systems such as IMI may be justified if the student throughput is large and the training is required over a long period or that is the only way to meet student schedule constraints.
(2) Content stability. If the training content requires frequent updates or revisions, IMI is less suitable than classroom, OJT, or self-study.
(3) Amount of practice required. If a lot of practice is required, consider IMI as an instructional media since practice time is limited only by the availability of the student and the equipment. In the classroom or OJT, an instructor is required, which is costly.
(4) A ROI analysis should be performed to include considerations of factors such as student time, instructor time, facilitator time, curriculum development and maintenance costs, infrastructure support costs, and the impact on readiness. Alternate methods may reduce student time in class, Temporary Duty (TDY) costs, and development/maintenance of courseware.

c. Training considerations include:

(1) Task criticality. If task performance is critical it would be reasonable to consider formal classroom training or OJT. Self-study would be a questionable training method for a critical task.
(2) Learning difficulty. An area where special interest should be placed is on a task that is difficult to learn.
(3) Training fidelity. If the training fidelity requirement is high, select a training method that uses or represents the actual equipment to train the process or procedures.
(4) Interaction level. If the learning process requires a great deal of interaction, OJT is probably the best since it is highly interactive. If the group size is small, classroom training can provide moderate interaction. Self-study may not be a good choice if the learning process requires high interactivity. Interactivity may be higher in a distributed learning environment rather than a traditional classroom.

7.10 Select instructional media. Although selection of training methods and media is discussed individually, they can't always be considered separately. No single medium is the most appropriate choice for every training situation. Proper media ensures that information is presented to the students by the most effective and cost-efficient means possible.

7.10.1 Media selection process. Media selection is a five step process, the five steps are:

a. Identify instructional concept and course and lesson strategy.
b. Identify sensory stimulus requirements for each LO.
c. Identify sensory stimulus features for all available media.
d. Match the sensory stimulus requirements with the sensory stimulus features to identify a candidate list of media.
e. Select the media delivery format based on resource constraints, classroom logistics, and all other relevant considerations.

7.10.2 What are media? Media are the delivery vehicles used to present instructional material or basic sensory stimulus presented to a student to induce learning. In other words, the means used to give information to the students. Some examples of media include classroom instructor, printed materials, and interactive video. There are several types of media such as:

a. Instructor/tutor including:

(1) Lecturer.
(2) Demonstrator.
(3) Tutor/coach.

b. Traditional audiovisual devices including:

(1) Chalkboards.
(2) Transparencies.
(3) Overhead projectors.
(4) Slides.
(5) Microfiche.
(6) Film strips (e.g., silent, pre-narrated, etc.).
(7) Videotapes.
(8) Slide/workbook/tape recorder combinations.

c. IMI products including:

(1) Interactive Courseware (ICW).
(2) Electronic publications.

(a) Electronic guides.
(b) Interactive Electronic Technical Manuals (IETMs).
(c) Electronic Technical Manuals (ETMs).

(3) Electronic testing.
(4) Simulation.
(5) Electronic management systems.

(a) Electronic Performance Support System (EPSS).
(b) Computer Aided Instruction (CAI).
(c) LMS.
(d) Computer Managed Instruction (CMI).
(e) Course Management System (CMS).
(f) Electronic job aids (e.g., templates, macros, etc.).

d. Other materials (digital or printed) including:

(1) Workbooks.
(2) Study guides.
(3) Job aids.
(4) Training manuals.
(5) Programmed instruction booklets.
(6) Technical orders.

e. Trainers including:

(1) Simulator trainers.
(2) Platform and component trainers.
(3) Combination platform and component and simulator (hybrid trainers).

f. ADL products including:

(1) On-line (e.g., Internet, intranet, extranet, etc.) courses including:

(a) Web-ready (e.g., Hypertext Markup Language (HTML, etc.), Extensible Markup Language (XML), synchronous, etc.).
(b) Web-deliverable (i.e., executable files launched via a browser).
(c) Web-based (i.e., asynchronous and synchronous instruction).
(d) Web-downloadable (i.e., content for off-line instruction).

(2) Compact Disk-Read Only Memory (CD-ROM), Digital Versatile Disk (DVD), and other digital storage devices.
(3) Broadcast television (including cable and satellite).
(4) Video conferencing.
(5) Audio conferencing.

7.10.3 Media characteristics. Media have various characteristics that make them either suitable or unsuitable for particular training situations. Consider these characteristics carefully to ensure that the appropriate media are selected for the instructional system. The advantages and limitations of each type of media are listed in Table 28.

TABLE 28. **Advantages and limitations of media delivery format types**.

FORMAT	ADVANTAGES	LIMITATIONS
Printed Materials	1. Include common types of materials. 2. Wide variety of applications. 3. Simple types are quick to prepare.	1. Sophisticated types more costly to prepare. 2. Requires suitable reading ability.
Overhead Transparency	1. Presents information in systematic, developmental sequences. 2. Simple to operate projector with presentation rate controlled by instructor. 3. Requires only limited planning. 4. Prepared using various simple, inexpensive methods. 5. Particularly useful with large groups.	1. Requires special equipment and skills for more advanced preparation. 2. Are large compared with other projectors.
Computer Video Presentations	1. Can present complex graphics and color schemes. 2. Relatively easy to prepare. 3. Provides maximum flexibility in sequencing and pace of the presentation with a minimum of work. 4. Most software allows for the development of speaker's notes and production of handouts. 5. The complexity of the graphics in the presentation can be useful in maintaining the attention of the students. 6. Flexibility for a wide range of presentation mediums (e.g., LAN/WAN/classroom, etc.)	1. Requires a data/video projector that is expensive and not always available. 2. If there is a computer/data file malfunction, the presentation is useless.
Audio Recordings	1. Easy to prepare using a variety of recording devices. 2. Can provide applications in most subject areas. 3. Equipment is compact, portable, and easy to operate. 4. Flexible and adaptable as either individual elements of instruction or in correlation with other materials. 5. Duplication is easy and economical.	1. Have a tendency for overuse, as lecture or oral textbook reading. 2. Fixed rate of flow. 3. Low fidelity of small portable recorders. 4. Utilizes only one sense.
35mm Slide Series	1. Requires only filming, with processing and mounting by film laboratory. 2. Colorful, realistic reproductions of original subjects. 3. Prepared with any 35-mm camera for most uses. 4. Easily revised and updated. 5. Easily handled, stored, and rearranged. 6. Tray storage and remote control by presenter. 7. Can combine with audio tape for greater effectiveness. 8. May be adapted to group or individual use.	1. Requires some skill in photography. 2. Requires special equipment for close-up photography and copying. 3. Can get out of sequence and be projected incorrectly.

TABLE 28. **Advantages and limitations of media delivery format types - Continued.**

Multimedia Presentations	1. Can command attention and create strong emotional impact on viewers. 2. Can compress large amounts of information into short presentation time. 3. Can provide for more effective communications than when only a single medium is used.	1. Requires additional equipment, complex setup, and careful coordination during planning, preparation, and use. 2. Equipment and production costs high for complex programs.
Interactive Courseware (ICW)	1. Presents text information and graphic images. 2. Can interact with students on individual basis through asking questions and judging responses. 3. Can maintain record of responses. 4. Can adapt instruction to needs of student. 5. Can control other media hardware. 6. Can interface computer and video for student-controlled programs.	1. Requires computer and programming knowledge. 2. Requires hardware and software to development/use. 3. Incompatibility of hardware and software among various systems.
Video and Film	1. Particularly useful in describing motion, showing relationships, and giving impact to topic. 2. Allows instant replay of video recording. 3. Videotape is reusable. 4. Easy to record lip sync on videotape. 5. May include special filming techniques (animation, time-lapse). 6. Combine still and motion on videodisc. 7. Standard film projectors are readily available. Note - Videotape is rapidly replacing 16mm film medium.	1. High cost for studio production equipment. 2. Resolution limited with video for fine detail. 3. Incompatibility of some video format types. 4. Value of investment in motion picture equipment reduced as video replaces film.
Part-Task Trainers	Less expensive to develop and maintain than a full capability simulator. Multiple units increase the number of trainees that can simultaneously practice a limited set of skills.	Isolates the limited number of skills from cues that may impact performance in the actual setting. Typically very restricted set of consequences which may limit the efficacy of training.
Simulators	Complete set of cues and consequences related to the training requirements. Trainees practice skills in the most realistic artificial training environment. Capable of scenarios that are not possible or practical in the actual setting (e.g., deployment of nuclear weapons, deployment/evasion of weapons in combat, etc.). Provides inexpensive practice in use of operational equipment.	Very expensive to develop and maintain. Must be constantly revised as operational equipment is upgraded, the theater of threat is changed, or adversary equipment is changed. Practice is limited to one person or team at a time.

7.10.4 Media selection by learning outcomes. Selections of training methods were discussed previously in this section. Selection of the right method(s) is important and has an

impact on selecting the best media based on the desired learning outcomes of the LO(s).

7.10.5 Media selection for integrated activities. Most types of complex skills involve multiple LOs from different domains of learning. A skill that involves two or more LOs from different learning domains involves integrated learning activities. Media selection for integrated learning activities must take into consideration the enterprise and the student's schema, metaskills, and experience as follows:

a. Enterprise. An enterprise is an integrated, purposeful activity that usually leads to accomplishment of a goal. For example, an individual might have an enterprise to build and fly an airplane. An individual does not have to have all the prerequisite skills to engage in an enterprise. The importance of an enterprise is that it is purposeful and relevant to the student. This motivates the learning behavior necessary to complete the component tasks.
b. Schemas. A schema is an individual's organization of knowledge. Schemas may take the form of scripts (a kind of story or scenario that organizes information) or frames (a structure that looks like a table or matrix into which information fits). Different levels of students have different types of schemas. A novice student (in a particular subject area) has a very sketchy schema or structure into which new information can be placed. An experienced student (one who has had some training in a subject area) has a better structure and therefore learns quicker than the novice. Finally, an expert has a very highly developed schema and is probably capable of rapid learning with very little learning support.
c. Metaskills. Metaskills are cognitive strategies that an individual applies to the processing of new information in a novel situation (a scenario not previously experienced). These skills include chunking or organizing new information, recalling relevant schemas, adding the new information to the old schemas, and creating new schemas. Although metaskills are probably subject-independent, different individuals have different metaskill capabilities depending upon their experience with a particular subject content. For example, an expert has developed metaskills and can relate better to a novel situation than a novice. An expert is more efficient at processing new information and applying it to the novel situation.
d. Student experience. It is helpful to know how experienced a student is when selecting media or teaching strategies. The more experience, the higher the level of metaskills and strategies the student will be able to employ. Experienced students can deal with larger steps of instruction and more complex learning environments. Novices, on the other hand, require simplification of complex contexts so they do not experience information overload while learning.

7.10.6 Guidelines for selecting media. Several guidelines for media selection are:

a. Select media that do not conflict with the specific training or job task environment.

b. Select media that effectively supports the LOs at the appropriate learning levels.
c. Select media that supports the training strategy.
d. Select media that allow individualization of training when appropriate.
e. Select media that will support anytime anywhere training.
f. Select media with time and dollar resources in mind.
g. Select media that are effective and cost-efficient.

7.10.7 Analyze sensory stimulus requirements. Each LO has inherent sensory stimulus requirements necessary for effective communication. A sensory stimulus is any action or agent that causes or changes an activity by stimulating/activating a human sense (e.g., sight, sound, touch, motion, odor, color, etc.). Table 29 lists the various forms of sensory stimulus associated with their respective domains. Assign to each LO the set of sensory stimuli required. Next, assign to each media a set of sensory stimuli that it supports as media features. Media selection is then simply a matter of matching the sets of sensory stimulus requirements with the list of media features. This process is particularly amenable to automation using the computer. Note, it would be very useful to retain the list of sensory stimuli assigned to media for re-use in other media selections. Given such a list the media features effort would be limited to updating the list to reflect technology changes for each of the media.

TABLE 29. **Sensory stimulus cues.**

VISUAL CUES	
Domain	**Type**
Brightness	Candle Power
Brightness	Contrasts
Brightness	Contrast in Illumination
Brightness	Dim Contrasts
Brightness	Glitter
Brightness	Gloss
Brightness	Glowing
Brightness	Gradual Contrasts
Brightness	Instantaneous Contrasts
Brightness	Level of Illumination
Brightness	Lack of Contrast
Brightness	Lack of Resolution
Brightness	Variable Luminance
Color	Brightness
Color	Black and White
Color	Contrasting
Color	Contrasting Brightness
Color	Dull
Color	Full Spectrum of Color Chart
Color	Gray
Color	Hue
Color	Shading
Color	Tint
Composition	Bold
Composition	Captions
Composition	Contrasting style of Type
Composition	Font Size
Composition	Font Style
Composition	Grouping
Composition	Highlight Color (use of)
Composition	Italics
Composition	Icons
Composition	Line Length
Composition	Lower Case Letters
Composition	Paragraph Indentations
Composition	Size Text
Composition	Space Between Lines
Composition	Style

VISUAL CUES	
Domain	**Type**
Composition	Titles and Headings
Composition	Underlining
Composition	Upper Case Letters
Composition	Upper and Lower Case Letters
Chart	Organization
Chart	Classification
Chart	Time Lines
Chart	Flowchart
Chart	Tabular (or table)
Field of View	30 degree
Field of View	90 degree
Field of View	180 degree
Field of View	360 degree
Field of View	30 degree - Azimuth
Field of View	90 degree - Azimuth
Field of View	180 degree - Azimuth
Field of View	360 degree - Azimuth
Field of View	30 degree - Elevation
Field of View	90 degree - Elevation
Field of View	180 degree - Elevation
Field of View	360 degree - Elevation
Form	3D
Form	Alphanumeric
Form	Angle
Form	Boundaries Clear and Complete
Form	Boxes
Form	Bubbles
Form	Contrasting
Form	Density
Form	Environment
Form	Liquid
Form	Map
Form	Non-translucent

TABLE 29. **Sensory stimulus cues - Continued.**

VISUAL CUES	
Domain	**Type**
Form	Numerals
Form	Rules
Form	Solid Object
Form	Split Image
Form	Static Display
Form	Symbols
Form	Symmetry
Form	Table
Form	Timelines
Form	Translucent
Graph	Bar
Graph	Line
Graph	Pictorial
Graph	Pie
Light	Black Light

VISUAL CUES	
Domain	**Type**
Light	Fluorescent
Light	Incandescent
Light	Infra Red
Light	Natural
Movement	Contrasting
Movement	Cyclic
Movement	Eye
Movement	Flowing
Movement	Full
Movement	Gradual
Movement	Hand Signals
Movement	Head

VISUAL CUES	
Domain	**Type**
Movement	Instantaneous
Movement	Jerky
Movement	Limited
Movement	Still
Perception	Acuity (sharpness)
Perception	Altered Depth
Perception	Angle
Perception	Area
Perception	Curvature
Perception	Capacity Levels
Perception	Depth
Perception	Diameter
Perception	Direction
Perception	Fidelity (exactness)
Perception	Fumes
Perception	Gradual Changes
Perception	Intensity of Shading and Color Saturation
Perception	Instantaneous Changes
Perception	Mirage
Perception	Length

VISUAL CUES	
Domain	**Type**
Perception	Position Along a Common Scale
Perception	Position Along Nonaligned Scale
Perception	Volume
Pictorial	Aerial
Pictorial	Animation
Pictorial	Cartoon-like Image
Pictorial	Diagram
Pictorial	Line Drawing
Pictorial	Moving
Pictorial	Representational Picture
Pictorial	Sketch
Pictorial	Still
Pictorial	Transformational Picture
Print	Checklists
Print	Instructions
Print	Procedures
Print	Reference Materials
Rate	Constant
Rate	Contrasting

TABLE 29. **Sensory stimulus cues - Continued.**

VISUAL CUES	
Domain	**Type**
Rate	Fast
Rate	Gradual Changes
Rate	Instantaneous Changes
Rate	Slow
Rate	Variable
Scale	Exact
Scale	Magnified
Scale	Proportional
Scale	Reduced
Sequence	Cartoon Strip Fashion
Sequence	Each Panel (one at a time)
Sequence	Indicated by Arrows, Numbers, Labels
Shape	Concave
Shape	Convex
Shape	Corrugated
Shape	Crooked
Shape	Fluted
Shape	Recessed
Shape	Spiral
Shape	Straight
Shape	Twisted
Size	Bony
Size	Chunky
Size	Compact
Size	Contracting
Size	Contrasting
Size	Dilated
Size	Elongated
Size	Gangling
Size	Height
Size	Large
Size	Lean
Size	Pudgy
Size	Slim
Size	Small
Size	Spindly
Size	Stature

VISUAL CUES	
Domain	**Type**
Size	Stocky
Size	Thin
Size	Width
Size	Willowy
Source	Smoke
Source	Fire
Structure	Background
Structure	Lines of Text Broken According to Sense (not space)
Structure	Page Design
Structure	Spatial Arrangements
Structure	Use of White Space
Temperature	Frost
Temperature	Ice
Temperature	Red Hot
Temperature	Simmer
Texture	Blunt
Texture	Braided
Texture	Braille
Texture	Bumpy
Texture	Clammy
Texture	Coarse Grained
Texture	Delicate
Texture	Fine Grained
Texture	Filmy
Texture	Furrowed
Texture	Gouge
Texture	Groove
Texture	Holey
Texture	Limp
Texture	Interlaced
Texture	Indentions
Texture	Jagged
Texture	Meshed
Texture	Notched
Texture	Prickly
Texture	Relief

TABLE 29. **Sensory stimulus cues - Continued.**

VISUAL CUES	
Domain	**Type**
Texture	Ribbed
Texture	Ridges
Texture	Rough
Texture	Rut
Texture	Scaly
Texture	Sharp
Texture	Sheer
Texture	Smooth
Texture	Soft
Texture	Spongy
Texture	Stubby
Texture	Velvety
Texture	Warped
Thermal Signature	Variable
Thermal Signature	Enumerable
Topography	Apex
Topography	Bank

VISUAL CUES	
Domain	**Type**
Topography	Crest
Topography	Crown
Topography	Elevation
Topography	Embankment
Topography	Peak
Topography	Zenith
Vibration	Constant
Vibration	Flutter
Vibration	Random
Vibration	Shake
Vibration	Shimmy
Vibration	Variable
Vibration Frequency	High
Vibration Frequency	Low
Wind	Ripples on Water
Wind	Flags
Wind	Sock

TACTILE CUES	
Domain	**Type**
Manipulate Foot/Leg	Foot Operated Pedal
Manipulate Foot/Leg	Foot Operated Switch
Manipulate Hand/Finger	Crank
Manipulate Hand/Finger	Grip
Manipulate Hand/Finger	Handle
Manipulate Hand/Finger	Hand Wheel
Manipulate Hand/Finger	Isotonic Joystick
Manipulate Hand/Finger	Keyboard

TACTILE CUES	
Domain	**Type**
Manipulate Hand/Finger	Knob
Manipulate Hand/Finger	Lever
Manipulate Hand/Finger	Mouse
Manipulate Hand/Finger	Thumb Wheel
Manipulate Hand/Finger	Touch Screen
Manipulate Hand/Finger	Switch, Continuous Rotary
Manipulate Hand/Finger	Switch, Discrete Rotary
Manipulate Hand/Finger	Switch, Key Operated

TABLE 29. **Sensory stimulus cues - Continued.**

TACTILE CUES	
Domain	**Type**
Manipulate Hand/Finger	Switch
Manipulate Hand/Finger	Switch, Push Button
Manipulate Hand/Finger	Switch, Rocker
Manipulate Hand/Finger	Switch, Slide
Manipulate Hand/Finger	Switch, Toggle
Resistance	Dense
Resistance	Hard
Resistance	Firm
Resistance	Hollow
Resistance	Impenetrable
Shape	Concave
Shape	Convex
Shape	Corrugated
Shape	Crooked
Shape	Fluted
Shape	Recessed
Shape	Straight
Shape	Twisted
Size	Chunky
Size	Compact
Size	Height
Size	Large
Size	Lean
Size	Length
Size	Pudgy
Size	Small
Size	Stocky
Size	Width
Temperature	Cold
Temperature	Cool
Temperature	Frigid
Temperature	Frosty
Temperature	Hot

TACTILE CUES	
Domain	**Type**
Temperature	Icy
Temperature	Languid
Temperature	Lukewarm
Temperature	Seethe
Temperature	Simmer
Temperature	Sizzle
Temperature	Swelter
Temperature	Tepid
Temperature	Torrid
Temperature	Warm
Texture	Blunt
Texture	Braided
Texture	Braille
Texture	Bumpy
Texture	Coarse Grained
Texture	Delicate
Texture	Fine Grained
Texture	Filmy
Texture	Furrowed
Texture	Gooey
Texture	Gouge
Texture	Greasy
Texture	Groove
Texture	Holey
Texture	Interlaced
Texture	Indentions
Texture	Jagged
Texture	Meshed
Texture	Notched
Texture	Prickly
Texture	Relief
Texture	Ribbed
Texture	Ridges
Texture	Rough
Texture	Rut
Texture	Scaly
Texture	Sharp
Texture	Sheer

TABLE 29. **Sensory stimulus cues - Continued.**

TACTILE CUES	
Domain	**Type**
Texture	Slick
Texture	Slimy
Texture	Smooth
Texture	Soft
Texture	Spongy
Texture	Sticky
Texture	Stiff
Texture	Stubby
Texture	Tightness
Texture	Velvety
Texture	Warped
Whole Body Movement	Body Orientation
Whole Body Movement	Incline
Whole Body Movement	Lurch
Whole Body Movement	Pitch

TACTILE CUES	
Domain	**Type**
Whole Body Movement	Pivot
Whole Body Movement	Roll
Whole Body Movement	Spin
Whole Body Movement	Sway
Whole Body Movement	Swing
Whole Body Movement	Tester
Whole Body Movement	Thrash
Whole Body Movement	Wobble

OLFACTORY CUES	
Domain	**Type**
Chemical	Almond
Chemical	Fruit
Chemical	Peach
Engine Exhaust	Gas
Engine Exhaust	Turbine
Fragrance	Sweet
Fragrance	Fresh
Fuel	Diesel
Fuel	Gas
Fuel	JP4
Gun Powder	Cordite
Odor	Antiseptic
Odor	Burnt
Odor	Electrical
Odor	Fire
Odor	Foul
Odor	Gaseous

OLFACTORY CUES	
Domain	**Type**
Odor	Hot
Odor	Hydraulic Fluid
Odor	Moldy
Odor	Musty
Odor	Oil
Odor	Ozone
Odor	Pungent
Odor	Rancid
Odor	Reeking
Odor	Rotten
Odor	Rubber
Odor	Smoke
Odor	Sour
Odor	Sulfuric
Odor	Stagnant
Odor	Stench
Odor	Sulfur

TABLE 29. **Sensory stimulus cues - Continued.**

OLFACTORY CUES	
Domain	**Type**
Odor	Tobacco
Taste	Acidic
Taste	Bitter
Taste	Salty

OLFACTORY CUES	
Domain	**Type**
Taste	Sweet
Taste	Tart

AFFECTIVE CUES	
Domain	**Type**
Attitude	Appreciative
Attitude	Assertive
Attitude	Authoritative
Attitude	Caring
Attitude	Confident
Attitude	Demeanor
Attitude	Diplomatic
Attitude	Emotional
Attitude	Hostile
Attitude	Impassive
Attitude	Nervous
Attitude	Self Control
Attitude	Sharpness
Attitude	Shifty
Attitude	Smug
Attitude	Superior
Attitude	Stoicism
Attitude	Timid
Attitude	Trustworthy
Attitude	Unfeeling
Physiological Condition	Blacked Out
Physiological Condition	Comatose
Physiological	Dazed

AFFECTIVE CUES	
Domain	**Type**
Condition	
Physiological Condition	Dizzy
Physiological Condition	Fatigue
Physiological Condition	Nauseous
Physiological Condition	Lethargic
Physiological Condition	Unaware
Physiological Condition	Numb
Physiological Condition	Painful
Physiological Condition	Shocked
Physiological Condition	Stress
Physiological Condition	Stunned
Physiological Condition	Unconscious
Physiological Condition	Vertigo

TABLE 29. **Sensory stimulus cues - Continued.**

AUDITORY CUES	
Domain	**Type**
Duration	Long
Duration	Medium
Duration	Short
Duration	Constant
Duration	Variable
Music	Background
Music	Constant
Music	Variable
Pitch	Constant
Pitch	High
Pitch	Low
Pitch	Medium
Pitch	Penetrating
Pitch	Piercing
Pitch	Variable
Quality	Constant
Quality	Mellow
Quality	Soothing
Quality	Strident (harsh)
Quality	Variable
Rate	Constant
Rate	Fast
Rate	Gradual
Rate	Instantaneous
Rate	Slow
Rate	Variable
Rhythm	Constant
Rhythm	Variable
Sound	Boom
Sound	Buzz
Sound	Chatter
Sound	Chirp
Sound	Chuckle
Sound	Clang
Sound	Click
Sound	Cry
Sound	Ding
Sound	Dong

AUDITORY CUES	
Domain	**Type**
Sound	Grind
Sound	Groan
Sound	Growl
Sound	Hiss
Sound	Hum
Sound	Knock
Sound	Peep
Sound	Ping
Sound	Pop
Sound	Rattle
Sound	Reedy
Sound	Roar
Sound	Rumble
Sound	Scream
Sound	Screech
Sound	Shrill
Sound	Shriek
Sound	Squawk
Sound	Squeak
Sound	Squeal
Sound	Tap
Sound	Ticking
Sound	Ting
Sound	Treble
Sound	Whine
Sound	Whir
Sound	Whistle
Sound	Yap
Sound	Yelp
Sound	Yip
Sound	Zing
Source	Buzzer
Source	Bell
Source	Klaxon
Source	Whistle
Tempo	Constant
Tempo	Fast
Tempo	Medium

TABLE 29. **Sensory stimulus cues - Continued.**

AUDITORY CUES	
Domain	**Type**
Tempo	Slow
Tempo	Variable
Timbre	Constant
Timbre	Tonal Sound
Timbre	Full Sound
Timbre	Ambient Sound
Timbre	Variable
Verbal	Abrupt Changes
Verbal	Babble
Verbal	Blab
Verbal	Change of Narration
Verbal	Chatter
Verbal	Constant
Verbal	Dialect
Verbal	Jabber
Verbal	Jargon
Verbal	Mumble
Verbal	Mutter
Verbal	Synthesized Speech
Verbal	Variable
Verbal	Whisper
Voice	Accents
Voice	Animated
Voice	Constant
Voice	Female
Voice	Inflections
Voice	Male
Voice	Human (real)
Volume	Constant
Volume	Strong
Volume	Variable
Volume	Weak

7.10.8 Media delivery format. The matching of sensory stimulus requirements with media features will result in a list of media requirements. However, the media may be packaged in various formats. For example, a given LO might require a motion visual with accompanying sound. This set of media could be formatted as a film, a video, or a computer image. The decision regarding media delivery format is made within the context of the media requirements for a set of LOs as they are scheduled within the course. Also, each of the issues examined previously (see, 7.3 through 7.9) should be considered when deciding on the media delivery format.

7.10.9 Media feasibility determination. After media is selected, an analysis should be conducted to determine that the selected media is practical, affordable, and supportable. Appendix E provides guidance in determining media feasibility. Consideration should also be given to multiple use of courses, lessons, or modules in alternative learning settings.

7.11 Analyze resource requirements/constraints. After identification of instructional strategies and methods and selection of media, the resources required to support the instructional program can be further defined. Resources are critical in every step of instructional system development, from the initial planning through training development, to operation and maintenance of an instructional system. During analysis, the identification of long-lead-time resource requirements such as training equipment and facilities is required in order to allow sufficient time to secure the needed resources or to develop alternatives in anticipation of resource constraints.

7.11.1 What are resources? Training resources are the supplies and support required to design, develop, implement, support, operate, and maintain an instructional system. Resources for an instructional system are categorized into five major areas as follows:

a. Equipment.
b. Facilities.
c. Funding.
d. Human resources.
e. Time.

7.11.2 Why analyze resources? Resource analysis allows for the identification and estimation of the resources required to design, develop, support, operate, and maintain a training system. Resource analysis identifies:

a. Course development resources.
b. Quantity of resources required such as number of instructors, classrooms, bandwidth, and trainers.
c. When the resources are needed in order to meet the training delivery date.

d. Total cost of resources.
e. Resource limits.
f. ROI.
g. Readiness.

7.11.3 Resource requirements considerations. When analyzing resource requirements, keep in mind the following:

7.11.3.1 Equipment. Identify new operational, system-peculiar, or unique equipment items required to support training as early as possible in the ISD/SAT process. Failure to identify requirements for training, support equipment, and test equipment to the operational equipment acquisition manager, early in the acquisition process, may delay training implementation. Order or procure equipment immediately after course objectives have been tentatively set and there is a valid requirement for the equipment. Develop a training system sustainment plan that outlines how operational equipment used in training will be modified as the configuration of the system it supports is modified. The training system needs to be upgraded before or at the same time as the system it supports to ensure personnel have training on the system configuration that is in use in the field. When selecting equipment, consider the following factors:

a. Suitability or appropriateness.
b. Usability.
c. Reliability.
d. Maintainability.
e. Cost.
f. Delivery time.
g. Maintaining configuration.

7.11.3.2 Facilities. Identify facility requirements as early as possible to allow sufficient time for budgeting and allocation of funds. A long lead-time may be required to build new facilities or modify existing facilities.

7.11.3.3 Funding. Prepare or revise a budget and get funds appropriated to allow for procurement of equipment, construction or modification of facilities, and personnel costs such as payroll, and TDY for instructors or students. Budgets are normally submitted and approved long before money is actually spent. Therefore, managers and instructional developers must determine, as early in the ISD/SAT process and as precisely as possible, what resources will be required for the instructional system.

7.11.3.4 Human resources. Lead-time for additional personnel such as instructional developers, instructors, student allocations, and maintenance support can be lengthy since it involves budget and personnel authorizations. When requesting personnel, such as instructional

developers and instructors, allow sufficient time to properly train them to do their assigned duties. Identify additional support personnel such as typists and hardware fabricators, if applicable.

7.11.3.5 Time. Allow sufficient lead-time to:

a. Obtain the necessary equipment.
b. Build new or modify existing facilities.
c. Get personnel authorizations approved and personnel properly trained.
d. Secure the required funding.
e. Design, develop, and implement an effective and cost-efficient training system.
f. Schedule equipment maintenance and updates.

7.11.4 Analyzing resource requirements. When analyzing the resource requirements for the instructional system, ask the following questions:

a. Equipment:

(1) What types of equipment will be required (e.g., training, support, test, etc.)?
(2) Will training equipment need to be developed?
(3) Is the equipment classified?
(4) What is the lead-time for equipment and parts?
(5) What equipment will be required (e.g., simulators, computers, maintenance stands, multimeters, etc.)?
(6) Where and how will the equipment be obtained?
(7) How will the equipment be used in the course?
(8) What quantities will be required?
(9) What is the life cycle of the equipment?
(10) In case of an equipment constraint, can alternative equipment be used? If so, what equipment?
(11) Will safes be required to store classified documents?
(12) Who will maintain the equipment?

b. Facilities:

(1) What types of facilities will be required (classrooms, laboratory)?
(2) Will a vault be required to store classified material?
(3) Will it be necessary to have secure classrooms?
(4) How much space will be required?
(5) Are Government facilities available?
(6) If Government facilities are available, will they require modifications?

(7) Who will do maintenance/housekeeping of facilities (contract or in-house)?
(8) Does the facility meet environmental requirements, if applicable?

c. Funding:

(1) What are the initial costs of equipment, facilities, and personnel?
(2) What are the recurring costs associated with operating the instructional system?
(3) Are there TDY costs associated with training development or the conduct of the course?

d. Human resources:

(1) How many instructional developers will be required to meet the training delivery date?
(2) Will qualified instructors be needed? If so, how many? What specialties?
(3) Will maintenance support be required? If so, will additional maintenance personnel be required?
(4) What are the student allocation requirements?
(5) Will the instructional system require additional overhead personnel?

e. Time:

(1) What is the training delivery date?
(2) How much time will be required to develop the training?
(3) Are there any equipment lead-time requirements? If so, for what equipment, and what are the lead times?
(4) If new or modified facilities are required, how long will it take?
(5) What is the estimated course length?

7.11.5 Resource constraints. Resources needed to support the training requirement may not be readily available. When faced with a resource constraint, consider the actions/alternatives listed below:

a. Equipment:

(1) Borrow equipment belonging to other training organizations or organizational units.
(2) Secure equipment from bases no longer in need of it.
(3) Share equipment with other training organizations or organizational units.
(4) Use prototype equipment.
(5) Use a trainer or simulator rather than the operational equipment.
(6) Increase group size on the equipment.

(7) Operate multiple shifts.
(8) Increase class intervals.
(9) Temporarily remove items from the training requirement.

b. Facilities:

(1) Use temporary facilities.
(2) Use other training organizations or organizational unit facilities.
(3) Operate on multiple shifts.
(4) Decrease the group size.
(5) Increase the class intervals.
(6) Delay start dates for classes.
(7) Outsource.

c. Funding:

(1) Reduce the resource requirements.
(2) Seek alternative funding sources.
(3) Predict ROI, readiness and costs.

d. Human resources:

(1) Reduce the number of graduates produced.
(2) Borrow instructional developers or instructors from other training organizations or organizational units.
(3) Reduce the multiple instructor requirements.
(4) Outsource.

e. Time:

(1) Borrow additional personnel such as instructors from other training organizations or organizational unit.
(2) Reduce course length.
(3) Select alternative methods or media.
(4) Outsource.

7.11.6 Updating resource requirements. Resources required to support the instructional system are identified during the initial planning and analysis. As training development progresses through the design and development phases of ISD/SAT, it will be necessary to continually redefine and fine-tune system resource requirements. Updating resource requirements helps ensure availability of adequate resources to support the instructional system.

7.12 Design lessons. The purpose of lesson design is to provide a transition from analysis and design to production of training materials. The lesson design will specify the subject matter content, training strategies, and learning activities for the development of instructional and testing materials. The following activities should be performed when appropriate during the lesson design process:

a. Identify learning types.
b. Determine instructional methods.
c. Determine course and lesson strategies.
d. Develop instructional guidelines.
e. Develop lesson overview.
f. Develop lesson components.
g. Develop lesson flow diagrams.
h. Develop a lesson resource requirements matrix.
i. Design instructional support materials.

7.12.1 Identify learning types. Learning types and learning levels were presented earlier in Table 13. Table 13 provides a taxonomy of learning and is separated into three learning types 1) knowledge, 2) skills, and 3) attitudes (i.e., KSA). Under each learning type are learning levels (e.g., fact learning, mechanism, competence, etc.). A taxonomy of learning such as that provided in Table 13 should be used for guidance when determining the sequence of topics within a lesson, and when sequencing lessons within a course.

7.12.2 Determine instructional methods. Various instructional methods are listed and defined in Table 30. In choosing the instructional method(s) for teaching a particular knowledge, skill, or attitude you should consider the learning type (See Table 13). This will probably still leave several alternatives. Student differences and availability of time and resources should determine which alternative is most appropriate.

TABLE 30. **Definition and classification of instructional methods**.

METHOD	DEFINITION
PRESENTATION METHODS	
Lecture	A formal or semiformal oral presentation of information by a single individual; facts, concepts, problems, rules or principles presented orally either directly (as by classroom instructor) or indirectly (as by tape recorder, film, or TV).
Demonstration	Presentation or portrayal of a sequence of events to show a procedure, technique, or operation; frequently combines an oral explanation with the operation or handling of systems equipment or material. May be presented directly or indirectly.
Exhibit	A visual or print display used to present information; for example, actual equipment, models, mockups, graphic materials, displays, chalkboard, projected images, or sand table.
Indirect Discourse	Verbal interaction among two or more individuals which is heard by the student; may be a dramatization, such as role playing, or a dialogue between panel members, or a teaching interview (a question and answer session between instructor and visiting expert).
Assigned Reading	Printed materials such as books, periodicals, manuals, or handouts. Readings may be course-assigned or self-assigned.
Small Group Method	A means of delivering instruction which places the responsibility for learning on the student through participation in small groups led by a leader who serves as a role model throughout the activity. The small group method uses small group processes, methods, and techniques to stimulate learning. The leader is an instructor who facilitates role modeling, counseling, coaching, learning, and team building in the small group. Under the small group method, brainstorming, buzz session, role playing, and committee problem-solving techniques may be applied.
Questioning	A presenter controlled interactive process used to emphasize a point, stimulate thinking, keep students alert, check understanding, or review material. Questioning may be direct, as by a classroom instructor, or may be designed into a film or TV presentation.
Programmed Questioning	A presenter controlled interactive process used to systematically demand a sequence of appropriate student responses; may be used directly (as by an instructor in a classroom) or indirectly (as by programmed booklets or teaching machines, including IMI).
Student Query	The provision by which students are given the opportunity to search for information, as by questioning a classroom instructor, tutor, coach, or an appropriately programmed computer.

TABLE 30. **Definition and classification of instructional methods - Continued.**

METHOD	DEFINITION
PRESENTATION METHODS	
Seminar	A peer-controlled group interactive process in which task- or objective-related information and experience are evoked from the students. Questions may be used to evoke student contributions, but the seminar is distinguished from questioning.
Discussion	An instructor controlled interactive process of sharing information and experiences related to achieving a LO.
KNOWLEDGE APPLICATION METHODS	
Performance	Student interactions with things, data, or persons, as is necessary to attain LOs; includes all forms of simulation (for example, games and interaction with hardware simulators) and interaction with actual equipment or job materials (for example, forms). Performance may be supervised by classroom instructor, tutor, coach, or peer to provide feedback.
Case Study	A carefully designed description of a problem situation, written specifically to provoke systematic analysis and discussion.

7.12.3 Determine instructional strategies. Instructional strategy is the principal vehicle for providing the level of human interaction required to meet the LOs for a target population. Most training is conducted using some form of traditional or programmed instruction. The selection of an instructional strategy has often been made by historical precedent (how did I learn to perform this task?) or by command mandate (you must use small group instruction). Each instructional strategy has been proven to be very effective when used with certain student populations, and has also been found to be less effective when used with other populations. The purpose of selecting an appropriate instructional strategy is to take full advantage of these powerful and proven learning tools without misusing them. Historically, many strategies met with failure in some areas they were used. This causes disenchantment with a strategy almost as quickly as it is adopted. Considerable resources are lost in translation from strategy to strategy. Appropriate initial selection conserves valuable resources. Six instructional strategies are addressed here. They are:

a. Programmed instruction.
b. Traditional instructor led classroom instruction.
c. Exercise, experiential, or experimental instruction.
d. Small group instruction (facilitator-led).
e. Peer/pressure group instruction.
f. Mentor or apprenticeship instruction.

7.12.3.1 Purpose of instructional strategies. The primary purpose for selecting an instructional strategy is to properly identify the learning situations that will assist students in meeting their LOs. Equally important is the identification of the situations in which certain instructional strategies are inappropriate and may have a negative impact on learning. Major factors, that have an impact on the choice of an instructional strategy, include:

a. The experience level of the student.
b. The degree of commitment desired of the student after training is completed (i.e., simply perform the task, sustain the skill to perform the task on your own, teach others to perform the task, or actively seek others to teach them how to perform the task).
c. The degree of anticipated resistance to training expected from the student.
d. The lesson strategy should consider the job task environment (i.e., a job task requiring team coordination) should be emphasized in the lesson strategy.

7.12.3.2 Primary instructional strategies. The six instructional strategies with situations where each is effective are:

a. Programmed instructional strategy. Programmed learning is highly structured interactive training (normally media delivered by programmed texts or interactive computer driven courseware). Situations where the programmed instructional strategy is effective are:

    (1) Programmed learning instructional materials are prepared to lead the student through a carefully structured set of learning events and activities which will allow the student to master the objective with very little additional live human interaction.
    (2) Programmed learning is especially effective for learning the basic terminology and procedures of a new skill. May provide unlimited drill and practice.

b. Traditional instructional strategy. Traditional learning is teacher-led classroom instruction. Situations where the traditional instructional strategy is effective are:

    (1) Traditional learning instructional materials are prepared to support lecture, conference, and discussion. Instructors use introduction, motivation, demonstration, practice, and evaluation of performance to transfer their knowledge and expertise to the student. They carefully structure the events and activities of learning to accomplish this transfer through continually encouraging the students to read the literature of the skill area and testing them on their mastery of the material. Instructors may proceed and attempt a different approach when students have not mastered the objective.
    (2) Traditional instruction is especially effective for mastering the existing knowledge base of the skill area.

c. Exercise, experiential, or experimental instructional strategy. Exercise, experiential, or experimental learning is instructor-planned exercises, experiences, or experiments, which lead the student to discover the principle or concept being taught. Examples of this kind of learning range from an individual student performing an experiment in a science class to a military field training exercise involving hundreds of students. Exercises may be developed to provide students practical experience using the actual job task technical manuals and tools. Situations where exercise, experiential, or experimental instructional strategy is effective are:

(1) Exercise, experiential, or experimental learning instructional materials are prepared to allow the learner to perform instructor-structured experiments or exercises as the primary tool in learning. It is the trial and error process that leads the learner to discover the theoretical principles involved in the skill being learned.
(2) Exercise or experimental learning is especially effective for committing to long-term memory the principles and theories which support the performance of a skill and developing those skills necessary to expand the base of knowledge.
(3) Exercises may be developed to practice collective job tasks.

d. Small group instructional strategy. Small group learning is the use of facilitator-led groups of 8 to 16 students to assist one another in learning to apply their collective group knowledge and skills to accomplish facilitator-assigned objectives. Situations where small group instructional strategy is effective are:

(1) Small group learning instructional materials are prepared to allow a group of learners to work through problems structured by the instructor/group facilitator. The students have considerable freedom to choose their own learning materials and pace.
(2) Small group learning is especially effective for mastering those skills which require several people to work together to solve complex problems. It is a very useful tool in training experienced personnel when consensus and commitment to implement change are important elements of the training.

e. Peer group or pure group instructional strategy. Peer/pure group learning is the use of groups to solve student-selected problems with the instructor’s assistance primarily as a learning resource coordinator. Situations where peer or pure group instructional strategy is effective are:

(1) Peer/pure group instruction instructional materials are prepared or selected to support the objectives chosen by the group itself. The instructor becomes a coordinator of the group itself. The instructor may provide some initial guidance

and direction to the group to ensure their objectives are compatible with the broad goals of the institution providing the training.

(2) The pure group process is especially effective for providing training to highly experienced people in the skills of creating new policy or in solving very complex problems.

f. Mentor or apprenticeship instructional strategy. Mentor or apprenticeship learning is the assignment of one student or a very small group of students to an expert performer for his personal supervision and modeling to assist them in mastering or gaining expertise in task performance. Situations where mentor or apprenticeship instructional strategy is effective are:

(1) The instructional materials in mentor or apprenticeship learning are often developed by the mentors themselves. This is in many ways the ideal form of learning from which all others are partial simulations. The expert with a single student at a time, with the actual equipment in the job environment is the ultimate instructional strategy and media.

(2) Mentor or apprenticeship learning is effective when the purpose of the training includes a high degree of commitment to the task from a student who is highly experienced and may be resistant to change.

7.12.3.3 Instructional strategy selection process. The following considerations should be applied when selecting an instructional strategy:

a. Consider the job task environment. Select instructional strategies relevant to the job task.
b. Consider the type of human interaction involved in each of the instructional strategies. Programmed learning includes many vicarious interactions between the student and the program, but usually has the least live human interaction. The human interaction becomes progressively greater with traditional learning, exercise learning, small group learning, peer/pressure group learning, and mentor or apprenticeship learning. The students also take progressively greater responsibility for structuring their own LOs.
c. Consider the level of experience of the student in the specific task or skill being trained. The higher the experience level of the students, the more personal the interactions must be to meet their individual learning needs related to the objective. Less experienced students may need more frequent interactions to learn; however, these interactions can be more easily programmed in a vicarious presentation with very little live human interaction.
d. Consider the level of commitment that the student must have after completing the training. The greater the need for commitment, the more personal the level of human interaction is required.

e. Consider the degree of probable resistance to mastering the objective that is present with the students when they appear for training. If resistance to training is present, personal or peer group interaction will likely be required to overcome it.
f. Media may be used to assist the training developer in selecting an instructional strategy for each task or LO. It will guide the developer through the considerations listed above as a part of media and method selection and will provide a recommended instructional strategy.
g. Consider how the student will be expected to perform on the job (e.g., will perform as part of a group, will perform as an individual, will interact with people, machines, or other available resources, etc.).

7.12.3.4 Instructional strategy selection output. An output is the recommendation of an appropriate instructional strategy for the initial training of each task or objective considered in the plan for the training program being developed. The plan should recommend instructional strategies that reflect the efficient and effective use of training resources.

7.12.4 Develop learning guidelines. In this handbook, a learning guideline is defined as the way in which the content of a lesson is arranged and presented to students. The common goals of a learning guideline are: maximum effectiveness (the fewest errors); maximum efficiency (least time to perform); maximum retention (continued low error rate over time); and maximum appeal (students feel that they are learning and seek additional opportunity to learn). Learning guidelines should be specified because all LOs do not require the same instructional treatment for optimum learning to take place. For example, remembering information (a knowledge LO) is not learned the same way as measuring pulse width using an oscilloscope (a skill LO). Each type of LO requires a different learning guideline. Experience shows that certain learning guidelines are more effective than others. Many curriculum developers already know that effective instruction should include:

a. Clear statements of what the student is supposed to be able to do after the instruction.
b. An introduction that motivates students to learn the material.
c. A precise presentation of the information to be learned.
d. An exercise designed to convey the learning experience.
e. Examples of how the material to be learned is applied.
f. Opportunities for the student to practice the material learned.
g. Information giving the correct answers to practice exercises and the reason for it.

7.12.4.1 Identify common error analysis and instance type. Perform an analysis of the common errors a student is likely to make during each lesson. The common error analysis result should outline the common logical errors the students are likely to make in working the practice and/or test items. The common error analysis results will assist in the development of instances which teach students to discriminate among similar, potentially confusing instances; for example

- two different emergencies may have all but one initiation cue in common and, therefore, be easily confused. Develop a description of each example, practice exercise, and test item. Also, develop a description of each type of instance that is to be included in the examples, practice exercises, and test items.

7.12.5 Develop lesson overview. Develop an overview of the lesson, including why the lesson is required and how it is related to the total instructional system. Describe the lesson content to support each LO, to include the learning type, instructional methods, instructional strategy, and common error analysis and instance type.

7.12.6 Develop lesson components. Lesson components can be defined as the identifiable elements that perform specific functions in the lesson. Lesson components are the basic building blocks of a lesson and are generally required if the lesson is to be maximally effective and efficient. Key elements or pieces of instruction that can be referred to as lesson components include: objective, introduction, essential or core information, examples or demonstration, practice, and feedback. For course and lesson strategy, see 7.8 for information on the various strategies that may be used to implement the lesson components. The following is guidance for the use of lesson components:

a. Lesson materials which teach performance objectives should normally require all six of the above lesson components. Lesson materials that teach knowledge objectives normally require only five of the six components. (Examples are not normally required in instructional strategies for knowledge objectives.)
b. When sequencing lesson components in a lesson it is also important to separate and identify each component for the student. A lesson is of higher quality when the lesson components (explanations, examples, and practice) are separated and labeled so students can easily locate and study each component as desired.
c. Too often the key elements of a lesson are buried in lengthy explanations, making it difficult to determine what core information the students are required to remember or use. This situation has been called "instructional hide-and-seek"; the instructor hides the critical information and the students try to find it.
d. To avoid such inefficiencies, the six lesson components (objective, introduction, essential information, examples, practice, and feedback) should be separated and clearly labeled so the student’s time can be spent learning the critical material instead of trying to locate it.
e. A lesson for a knowledge LO should be presented in the following manner. After introducing the lesson, state briefly and concisely the essential information the student must remember. Exclude all nonessential information from this statement. Next, give the students some additional assistance to help remember the information. Some ways to do this are to relate the new material to previously learned material, or to memory aids such as rhymes, jingles, etc. Next, give the students practice remembering the material

and immediate feedback regarding the correct answer. The more there is to be remembered, the more practice that is needed.

7.12.6.1 Lesson components for knowledge LOs. When developing lesson materials for most knowledge LOs, include the LO, introduction, essential or core information, practice, and feedback, as follows:

7.12.6.1.1 Knowledge Lesson Component 1: Objectives. Objectives should be clear statements of what the student is expected to be able to do after the instruction. They also provide the conditions and standards of performance. Objectives in instructional materials should be written in terms that students can understand.

7.12.6.1.2 Knowledge Lesson Component 2: Introduction. The introduction provides the necessary student orientation, overview, purpose, and instructions to prepare students for instruction and provides smooth transitions between lessons. An introduction could answer any of the following questions about the lesson:

a. What is the lesson about?
b. Why do I have to learn the information or skill presented in this lesson?
c. How does this lesson relate to previous or future instruction?
d. Is there anything especially interesting about the topic(s) presented that would motivate me to learn?
e. Is there anything else I need to know about this lesson that has not been presented previously or recently?

7.12.6.1.3 Knowledge Lesson Component 3: Essential or core information. Essential information is the facts, names, events, functions, definitions, procedures, formulas, etc., which students must be able to recall or recognize. Essential information should be presented in lesson materials as follows:

a. Give the student a concise, brief statement of the essential information that must be recalled or recognized. Exclude all nonessential information.
b. Give the student some additional help in remembering the material.

7.12.6.1.3.1 Knowledge statements of core information. These are the simplest, most concise statements of the critical information required to meet the objective. An adequate statement satisfies the following criteria:

a. Accurately and exactly states all information necessary to meet the objective. In order to meet the objective, students must have access to all of the necessary information. In

addition, that information must, of course, be accurate. Also, only the material required by the objective should be presented - nothing else.

b. Specifies by title, the information to be learned, and when appropriate, gives the number of items. It is important to include a title so the student can easily recall the information. Titles or names are particularly helpful when several items of information are involved, because they organize the information so the relationship between the items is clear. Also, if several items of information are to be learned, knowing the number helps the student keep track of the pieces of information. For example, in learning a list of six items, the student knows immediately that their performance is inadequate if they can only state five of the six items. In determining whether the number of items is necessary, check the objective to see if it requires listing behavior. If so, including the number of items will be helpful to the student.

c. Is concise and logically organized. Statements of essential information should be presented as briefly as possible while still providing all the information necessary to meet the objective. Organizing the material logically helps to achieve conciseness. It also makes the material far easier to learn. For example, suppose students are asked to remember the basic type of currency for each of 51 countries. Arranging the countries alphabetically would make the learning task a lot more difficult than it should be. A more logical approach would be to present the countries grouped by currency type. In addition, information should be presented briefly and in table or list form, whenever possible, to make the information easier to locate.

d. Excludes all nonessential information. If nonessential information is included in a statement of core information, students may think they have to learn it to meet the objective. This is unnecessarily confusing and decreases the effectiveness of the instruction. If the nonessential information is helpful as background information, include it in the introduction or as additional information. If it is critical information, but not required by the objective, it should be taught in another lesson.

e. Avoids unknown or unfamiliar terms and symbols whenever possible. When unknown or unfamiliar terms or symbols appear in the statement of essential information, its effectiveness is weakened. Whenever possible, all terms or symbols should have been addressed in previous lessons. If it is not possible to avoid using unfamiliar terms or symbols, explain them in the introduction or as additional information.

f. Provides additional help. Even though the core information which students must remember has already been precisely stated, most students will need additional help in remembering the material. The "additional help" should be separated from the "core information" and clearly labeled so students can locate it and understand what portion of the lesson they are studying.

g. Relates the new material to previous learning. Often, what students already know can help them learn new material. This can be done by referring back to earlier learned information ("The controls for the ASQ-10 are very similar to those of the ASQ-81 . . . ") or by using an analogy. Analogies are only useful if not contrived and if clearly related to

the new material. For example, in teaching how voltage, resistance, and current operate in a circuit, the analogy of a water pump could be used.

h. Illustrates the material in a memorable way by using graphics. Graphics can be used to explain information that was initially presented in written form. For example, if students are asked to memorize the locations of all the fire extinguishers in a building, a drawing pinpointing all their locations graphically could be very helpful.

i. Uses a rhyme, acronym, mnemonic, or other memory aid. Clever rhymes and acronyms are often used to help students remember facts. For instance, to help remember the number of days in each month, there is the rhyme that begins, "Thirty days hath September . . . ." To help remember the notes of the treble clef that appear between the lines, we use the acronym FACE. Whenever either of these techniques are used, remember that while clever rhymes and acronyms are very helpful, contrived aids are very confusing. When materials do not lend themselves to the creation of good rhymes or acronyms, it is better to use a different type of help.

j. Organizes the steps, operations, or critical characteristics into small groups. Experience indicates that most students can memorize lists of five to nine items fairly easily. Therefore, when teaching a long list of steps, operations, or critical characteristics it may be helpful to break the list into smaller groups. Students may find it easier to learn three small groups than one long list. To work most effectively, there should be some logic behind the way the items are grouped together.

k. Illustrates each step, operation, or critical characteristic in a memorable way by use of graphics. Associating something to be remembered with a vivid, visual image is often useful. In such cases the graphic should be as unambiguous as possible. This means that the graphics used should be concrete in nature and that each should illustrate some particularly distinctive feature of the step or characteristic to be memorized. This technique is particularly useful if the content being taught is inherently visual. For instance, it would be very easy to illustrate the characteristics of a bicycle (two wheels, pedal-powered) because wheels and pedals can be seen. These characteristics are concrete rather than abstract.

l. Presents a memorable description or example of the steps, operations, or characteristics. If the content being taught is not easily illustrated by a graphic, a vivid written image can sometimes be developed. The students read the written description, form an "image" in their minds of the step being performed or the characteristic described, and then use that to help retrieve from memory the things memorized. As with a graphic image, any written description or example should be concrete and should describe some particularly distinctive feature of the step or characteristic.

m. Clearly links the help to the core information to be learned. Any help used should be fully explained so students do not have to figure out what to do with the information to be learned. For example, when using the water pump analogy to teach how voltage, resistance, and current operate in a circuit it would be necessary to tell the student why the analogy was included and how it was supposed to explain the core information.

n. Does not add substantially to the memory load. Any help or memory aid should be brief, sensible, and easy to learn. Complex and hard-to-learn memory aids are useless because they only add to the difficulty of learning the important core information.
o. Excludes nonessential information from the additional help. Nonessential information is undesirable because it only clutters the help and draws attention away from the essential information.
p. Provide directed activity to include on-line direction to perform scenarios, conduct discovery, exercises, engage in conferencing, collaboration, etc.

7.12.6.1.4 Knowledge Lesson Component 4: Practice. Practice is probably the most important part of the lesson. It is the key for learning. The more there is to be learned, the more practice is needed. For knowledge objectives, practice items require students to state or recognize facts, objects, names, functions, formulas, definitions, etc. Some or all of the following guidelines for developing adequate practice items for recalling and recognizing LOs may apply:

a. Require the student to perform the exact task as stated in the objective and to use the same conditions and standards. If the conditions state that the student will be given an illustration, sample items, an incomplete table, or any other information, the final practice conditions should provide the same information or materials. Further, if the action says "state" the item directions should require the student to make a stated response (either stating or listing some information from memory). Also, if the standard requires including all notes and cautions (or some other special response) the item directions should indicate that requirement.
b. Require only information found in the statement of core information. A practice item may test only the information contained in the core information. If a practice item tests information that the author and SMEs agree is important, that information should be included in the core information.
c. Use the appropriate test item type. The item format should be appropriate for testing the kind of behavior called for by the objective. If the objective requires recall, then merely recognizing the answer in a multiple-choice question is not an adequate final practice item.
d. Provide adequate directions and space for completing the item. Each practice item should tell the student how to make the desired response, ("state the items in the space provided below," "circle the appropriate answer," "label the controls on the attached illustration by writing the name next to each relevant control," etc.) what information is given in the item, and the criteria for performance (if exact order is important, or exact words or paraphrase acceptable). Directions should be complete and specific. Also, provide adequate space for a complete response. The amount of space needed for the average student to make a complete response should be provided after the item. For fill-in-the-

blank, short-answer, or multiple-choice items, lines should be drawn to indicate the placement of answers.

e. Use graduated practice for objectives that require recalling complex or lengthy information. This is used only when students need more help to learn the necessary information. Graduated practice goes from easy to hard so that the student gradually masters the objective, thereby making final recall easier. Initial practice items should be similar to and less difficult than the final behavior indicated in the objective.
f. Remember to keep in mind that recognition behavior is not as difficult as recall behavior, and that cued recall is not as difficult as unprompted recall. Therefore, during graduated practice, ask students to perform a less difficult recognition task (multiple-choice or matching) than they need to demonstrate when doing the final practice for recall. For example, graduated practice might first require students to "match" symbols and their meanings, then to "fill in" part of them, and finally to list (recall) all symbols and their meanings.
g. Graduated practice should call for responses that are only portions of the total response required in the final practice. For example, if teaching a long, complex list that was easily divided into three smaller groups, the graduated practice might require students to list the first group, then the second, then the third, then the first and second groups, until they could list all of them without error. The final practice item would require students to list the entire list given in the essential information.
h. Graduated practice should present more cues than are presented in the final practice. If the final practice requires recall without cueing, then the graduated practice may use cued recall.
i. Graduated practice should sequence toward accomplishment of the final practice item(s). It is appropriate, when more than one activity is designed, that the requirements of the activities become gradually more difficult, coming closer and closer to the behavior required in the final practice item. In other words, during graduated practice, students are asked to remember larger and larger portions of the material they need to learn with fewer and fewer cues. Remember, however, graduated practice should not be more difficult than the final practice. The final practice item should be the ultimate goal.

7.12.6.1.5. Knowledge Lesson Component 5: Feedback. Feedback for knowledge level lessons provides students with the correct answer to compare with their responses. To develop adequate feedback:

a. Provide an immediate and complete answer to the item. All parts of the correct answer or answers should be provided. If alternative answers are acceptable, each should be included.
b. Provide the student with immediate access to the feedback. For example, place the feedback on the back of the practice page or on the next page. On-line instruction will require establishment of feedback procedures.

c. Clearly display the feedback and identify the item to that it relates. This is especially important if there are a number of answers on a page. In any situation, however, students should be able to locate answers as quickly as possible. The feedback should be numbered in the same way as their corresponding practice items. It is also helpful to place the feedback in the same locations on their pages as their corresponding practice items. Answers should be displayed in the same manner students were asked to supply them.
d. Provide guidance for remediation. The purpose of feedback is to help students learn the material. Therefore, it should be designed so that the student is led to restudy the information they failed to recall or recognize.

7.12.6.2 Lesson components for skill LOs. When developing lesson materials for most performance objectives, include the following components: Introduction, Essential or Core Information, Examples or Demonstration, Practice and Feedback. Guidelines for developing lesson components for skill type LOs are as follows:

7.12.6.2.1 Skill Lesson Component 1: Objectives. Objectives should be clear statements of what the student is expected to be able to do after the instruction. They also provide the conditions and standards of performance. Objectives in instructional materials should be written in terms that students can understand.

7.12.6.2.2 Skill Lesson Component 2: Introduction. The introduction provides the necessary student orientation, overview, purpose, and instructions to get students ready for instruction and provides smooth transitions between lessons. An introduction should answer any of the following questions about the lesson:

a. What is the lesson about?
b. Why do I have to learn the information or skill presented in this lesson?
c. How does this lesson relate to previous or future instruction?
d. Is there anything especially interesting about the topic(s) presented that would motivate me to learn?
e. Is there anything else I need to know about this lesson that has not been presented previously?

7.12.6.2.3 Skill Lesson Component 3: Essential or core information. Provide the student with a brief, concise statement of the essential (core) information needed to perform the lesson objective. All nonessential information should be avoided. The purpose for stating the core information is to organize, in advance, clear-cut information about what is to be learned. Statements of essential information for performance LOs should include the following as applicable:

a. Lists of the steps or operations required to perform the objective. Explicit safety precautions should be included as separate steps. (Include definitions of unfamiliar terms in formulas.)
b. Lists of the critical characteristics that students will need to distinguish one object from another (friend or foe, common cold or pneumonia).
c. A statement of the rule or regulation to be followed.
d. After stating the core information, provide an explanation of how to apply it. The "Core Information" and "Explanation" should be separate and identified so students can locate them. Even though the core information contains all the information necessary to perform the objective, most students require additional explanations and guidance on how to apply it. A variety of techniques may be used to accomplish this (one or more may apply); the following are some examples:

    (1) In the explanation, relate the core information to the student's prior knowledge or experience. For example, "As you remember from Lesson Topic 3.5 ..."
    (2) In the explanation, give the reasoning behind the core information. Explain why some piece of information is particularly important or why something is performed the way it is. Understanding why helps students remember and apply the information.
    (3) Make the explanation job relevant. For example, include a description of the job environment and how the information will be applied on the job.
    (4) If no job aid is provided, ensure that students can recall all the steps, operations, or critical characteristics stated in the core information before they are required to apply it in practice exercises and tests. Using one or more of the following techniques can make the information easier to remember:
    (5) Create a visual or verbal memory aid to help students remember the most difficult steps or characteristics. For example, aviators use this jingle to help them remember whether to add or subtract magnetic variation: "East is least and West is best."
    (6) Organize the steps or operations into small groups. Most students can memorize lists of five to nine items fairly easily. To work most effectively, there should be some logic behind the way items are grouped together.
    (7) Illustrate each step or operation in a memorable way by use of graphics.
    (8) Show an example or demonstration of how the rule or procedure is applied to a specific situation (demonstrations are always used when teaching procedures.) They may be performed live by an instructor or presented in audiovisual form or in a workbook.
    (9) Point out and explain common errors. Include in the explanation errors that are typically made in performing the task. Provide an explanation of how the errors can be avoided.

(10) Use pictures, illustrations, graphics, etc., when appropriate, as most students learn better when pictorial information is included in the text (or lecture).

7.12.6.2.4 Skill Lesson Component 4: Examples or demonstrations. Examples are used for rule and classification objectives and demonstrations are used for procedure objectives. Instructional strategies for categories of objectives that involve use of rules, regulations, and classification require many examples showing how the core information is applied to a variety of situations. Since procedures are performed in the same way each time, examples are not required; only a demonstration showing how the steps are performed. Some or all of the following guidelines for developing adequate examples may apply:

a. Cover the full range of situations or data that students may encounter.
b. Point out and explain common errors, or situations that most students find difficult. Include common errors typically made on the job.
c. Ensure that examples range from easy to hard.
d. Present a step-by-step application of the objective. When objectives have specified steps, the examples should include a step-by-step application with each step clearly indicated and labeled. For a formula, each logical step should be presented clearly.
e. Ensure that all examples are consistent with core information, practice, and test items.
f. Present examples and non-examples for classification LOs. Students usually learn better when both examples and non-examples of the object being classified are presented. Showing non-examples that lack one critical characteristic of the object and pointing out the missing characteristic, will help students learn to recognize legitimate examples.
g. Present demonstrations. Since procedures are always performed the same way on the job, only one example of how the procedure is applied is required. A demonstration is used as a concrete example of how a procedure should be performed and includes explanations of difficult steps. Procedures may be performed live by the instructor, on-line, downloadable, presented in audiovisual form, or appear in a workbook. Guidelines for developing adequate demonstrations are as follows:

(1) Begin with a description of the specific situation in that the procedure will be demonstrated. Include all necessary tools and equipment.
(2) Cover all steps in the order presented. Point out and explain common errors.
(3) Indicate all steps requiring decisions and show the response for each decision. Although most procedures involve a set of steps, all of which are performed the same way every time, some procedures may require decision steps within the procedure. Draw the student’s attention to these steps. This can be done by using the "if ..., then ..." format.
(4) Exclude all nonessential information from the demonstration.

7.12.6.2.5 Skill Lesson Component 5: Practice. Since the purpose of instruction on performance objectives is to prepare the student to perform the LO, adequate practice is essential to achieving this goal. Failure to provide adequate practice is a common mistake when developing instructional materials. Practice items are generally self-graded. Both practice and test items use the same form but are generally alternate versions. Guidelines for developing adequate practice items as follows:

a. Provide enough practice. Provide students with multiple opportunities to apply the rule, regulation, or classification across a full range of situations that will be encountered on the job. There should be sufficient practice for even the slowest students to learn the material.
b. Provide students with the opportunity to make common errors. Practice feedback should then clearly show why the procedure is wrong and how to correct it.
c. Practice items should progress from easy to hard.
d. Practice items should be like test items. They should be free of hints and additional instruction.
e. All practice items should be consistent with the LO, lesson presentation, examples, and test items. When a student finishes the practice items, there should be no doubt about what the test will be like.
f. Practice items may be made available to the student through many different media (e.g., on-line, CD-ROM, downloadable, etc.).

7.12.6.2.6 Skill Lesson Component 6: Feedback. It is important that the student be informed of the quality of their performance on practice items as soon as possible. For performance objectives, it is usually not enough to merely give the students the correct answer. They should also be given an explanation of how to arrive at the correct answer so they are able to find their mistakes. Feedback could also direct students to the appropriate sections in the study materials for remedial help. To develop adequate feedback for practice items:

a. Give immediate feedback on each practice item. Show the correct answer and give an explanation of how to arrive at the correct answer.
b. For practice involving a step-by-step format, the feedback should show all the logical steps worked out.
c. Point out and explain common errors that may have been made.
d. When possible, include additional information in the feedback or a different version of the information.

7.12.7 Develop lesson flow diagrams. Develop top level flow diagrams showing the sequence and relationships among topics within the sections and LOs within the lessons.

7.12.8 Design instructional support materials. Prepare design specifications for each item of instructional materials, such as overhead transparencies, charts, worksheets, etc.

7.12.9 Prepare lesson resource requirements matrix. Prepare a summary of resource requirements for each lesson in a matrix form.

7.13 Update ISD/SAT evaluation plan. An ISD/SAT evaluation plan was developed during the initial stages of ISD/SAT project planning. This plan was updated in the analysis phase of ISD/SAT to ensure that it remained an effective tool for evaluating the quality of the ISD/SAT process and products. Likewise, at the end of the design phase, the evaluation plan should be updated again as necessary.

7.13.1 Assessing quality. ISD/SAT is a quality management process. There are different ways to assess the quality of the design phase. One of the simplest ways is to develop a job aid using questions focused on quality improvements. Examples of questions for assessing quality are as follows:

a. Does the ISD/SAT evaluation plan assess the quality of both process and products in the design phase?
b. Can the instructional design process be improved? If so, how?
c. Are the metrics or standards for the design process and products realistic and adequate? If not, why not?
d. Can the products of the design phase, such as LOs and tests, be improved? If so, how?
e. Are the products of the design phase accurate?
f. Do the products of the design phase contain adequate information? If not, what information should be added?
g. Do the products of the design phase contain information that is not needed?
h. Are products that are not needed being developed during the design phase?

7.13.2 Why update the plan? Most ISD/SAT projects are dynamic in nature. Therefore, as the design phase is completed, it may be necessary to update the evaluation plan. Updating the plan ensures that the most current and accurate information is used when evaluating the process and products of the development phase.

7.13.3 What should be updated. After the design phase is complete the update of the ISD/SAT evaluation plan may include, but not be limited to:

a. Revisions to the plan such as:

(1) Procedures to be used in evaluating the design process and products.
(2) Design products to be evaluated, such as LOs and test items.

(3) Standards to be used to evaluate the design process and products.

b. Revisions to the evaluation schedule, such as:

(1) When the design process and products will be evaluated.
(2) Evaluation criteria to determine the required quality of the products to be evaluated.
(3) How the evaluation is to be conducted.

c. Results of the design phase.
d. Rationale for changes made to the ISD/SAT evaluation plan.
e. Lessons learned during evaluation of the design process and products.

7.13.4 Tracing the quality process. Quality of the design process and the resulting products is essential to the training development process and is documented in the evaluation plan to the point that the quality process can be traced throughout the entire ISD/SAT process. However, document only what is needed; never document more than needed.

7.14 Update management strategies. Management strategies provide a road map for managing instructional systems during the analysis phase and guiding instructional development during the design phase. During the design phase, there is a need to update the management strategies to reflect current information and the latest status of the project. The update may include new or revised milestones, changes in resource constraints, or revisions to resource requirements.

7.14.1 Importance of management strategies. Management strategies ensure that the training project is on track, on schedule and under budget. Remember, instructional strategies:

a. Serve as a tool for managing the instructional system and the instructional development process.
b. Establish milestones for instructional development and correlate with the operational system milestones.
c. Ensure that an effective and cost-efficient instructional system is developed.

7.14.2 Why update management strategies? Design is a dynamic process and the job of maintaining management strategies for training is a continuing one. Updating management strategies ensures that they reflect the current status of the project and remain an effective management tool. For example, during the design phase, it is learned that not all of the classroom and laboratory space needed is available and will have to use a smaller facility. An update in the management strategies is required to reflect information such as changes in the number of groups that may be in session, group size, and equipment requirements. If the management strategies are not continually updated, they can quickly become outdated, not

reflecting the current status of the project. Management strategies should be updated upon completion of the training design phase. The updated strategies enable entrance to the development phase with the latest "road map" of where the project is going and how it is going to get there.

7.14.3 What should be updated? When updating management strategies, include the latest information from the design phase such as:

a. Changes to the overall management strategy for the instructional system and process.
b. Changes to refine the definition of the project.
c. Revisions to the resource requirements.
d. Changes in resource constraints.
e. New or revised milestones.
f. Addition or deletion of taskings.

7.15 Design job aids. For detailed guidance on designing job aids, see Appendix C.

8. ISD/SAT DEVELOPMENT PROCESS

8.1 General. After the LOs have been specified, test items developed, strategies and activities planned, the design may be implemented. Some of the tasks in this phase include developing job aids, writing lesson materials, developing tests, producing training media, developing ICW, etc. This is the point where all efforts from earlier phases of ISD/SAT start to come together. Figure 17 depicts the ISD/SAT model with the development phase highlighted.

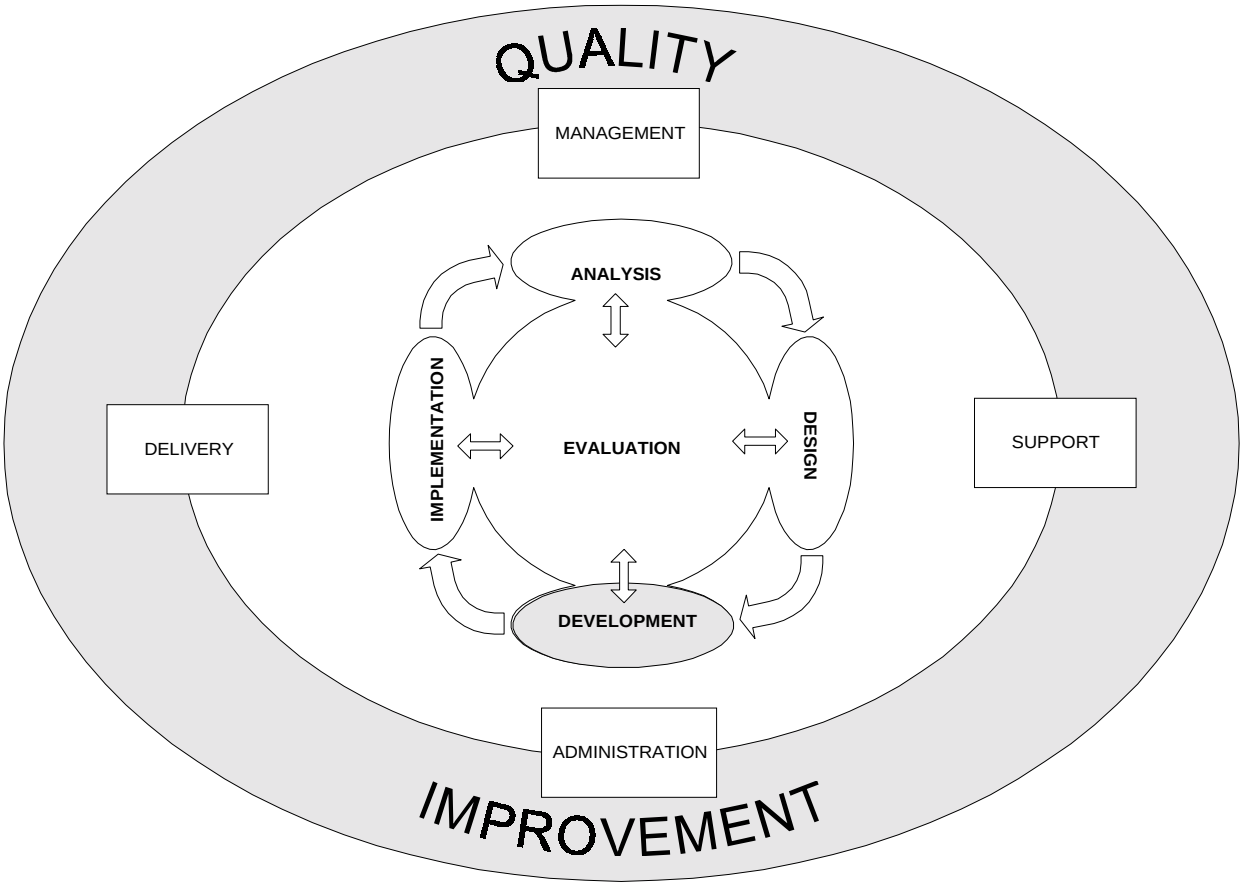

FIGURE 17. **ISD/SAT development phase**.

8.1.1 Development process flowchart. The development portion of the instructional development flowchart (see Figure 18) is provided below to show the activities involved in the training development process. The events described in this section are listed in a sequence that is only provided to aid in a better understanding of the development process. In practice, the events may be performed sequentially as presented in this handbook, some may be skipped, iteration among some events may be required, or a different sequence may be used. Various factors may affect the sequence or scope of the events used, such as Service needs, scope or complexity of the training project, or other factors. The events to be applied and their sequence should be documented in the specific project management plan.

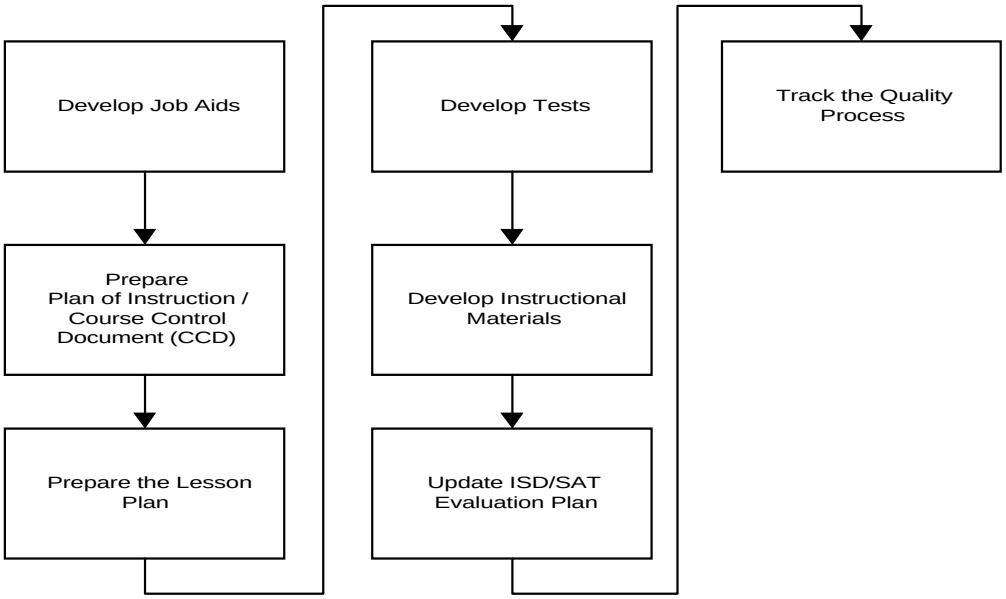

FIGURE 18. **Development process flowchart**.

8.2 Develop job aids. Job aids may be used to supplement or replace training for certain tasks. Appendix C provides guidance for the development of job aids.

8.3 Prepare plan of instruction/Course Control Document (CCD). The plan of instruction/CCD serves as the overall plan or blueprint for conducting training in a given course. In some training organizations a course syllabus is used for the same purpose. The plan of instruction/CCDs standardize instruction and control its quality. The plan of instruction/CCD is a control document used for planning, organizing, and conducting training.

8.3.1 Plan of instruction/CCD contents. Plan of instruction/CCDs expand the basic course control documents and provide necessary details for an instructor to develop specific lesson plans. Although the plan of instruction/CCD can be in different formats, it is normally organized by units or modules of instruction with each unit containing information such as:

a. Name of instructor.
b. Course title.
c. Unit or block title.
d. Course content.
e. Time allocations for each block or unit.
f. LOs.
g. Student instructional materials.

h. Audiovisual equipment.
i. Training equipment.
j. Training method(s) and time.
k. Instructional guidance.
l. Plan of instruction approval date and signature.
m. Plan of instruction/teaching guide.

8.3.2 Guidelines for plan of instructions/CCDs. The format of the plan of instruction/CCD is determined by the organization providing the instruction. The basic guidelines for preparing a plan of instruction/CCD or syllabus are that it should:

a. Document the plan of instruction.
b. Be easily maintained.
c. Meet the organization's needs.

8.4 Prepare the lesson plan. The lesson plan, that is based on the lesson outline that was developed during the design phase, should provide specific definition and direction to the instructor on LOs, equipment and instructional media requirements, and the conduct of training. Teaching techniques and methods, exercises, and applications that will enhance the teaching-learning process should be included in the lesson plan.

8.4.1 Purpose. Proper development of the lesson plan is important since the document will serve as the instructor's primary teaching aid.

8.4.2 Development procedures overview. Much of the groundwork has already been laid for developing lesson plans. Hierarchies of LOs have been developed for each TLO and test items have been developed as well. The content of the lesson plan is described in the following paragraphs.

8.4.2.1 Front matter. Content and style of the front matter should be in accordance with Appendix A of MIL-PRF-29612, and may be tailored. It may contain the following:

a. Cover.
b. List of effective pages.
c. Letter of promulgation.
d. Change record.
e. Hazard awareness notice.
f. Foreword.
g. Preface.
h. Definitions.
i. Table of contents.

j. List of illustrations.
k. List of tables.
l. How to use the lesson plan.
m. Executive summary.
n. Security awareness notice. Refer to the most current instructions for security program requirements to ensure that all training materials are marked and handled in accordance with the latest policy guidance. Each lesson plan should bear the highest security classification demanded by its contents, and a security awareness notice needs to be added to the front matter (probably between the change record and hazard awareness notice). The security awareness notice should:

    (1) State whether classified material is contained in the course.
    (2) Give specific directions to the instructor on handling, marking, and stowing a classified lesson plan.
    (3) Provide directions the instructor should give the student regarding handling, transporting, and stowing reference documents or trainee guides.
    (4) Give directions to the instructor for special security arrangements that might be made if, for example, foreign nationals or contractors were to take the course.

8.4.2.2 Lesson topics. The lesson topics portion of the lesson plan provides specific definition and direction to the instructor on LOs, equipment, instructional media requirements, and the conduct of the course. The lesson plan traditionally is produced in landscape layout (horizontally oriented) however, the contract/sample package could specify production in portrait layout (vertically oriented). Continuing discussion of content is provided as guidance.

8.4.2.2.1 Administrative information. Administrative information should provide the administrative information required to prepare for and conduct the lesson. Administrative information may consist of:

a. Course title.
b. Course Identification Number (CIN).
c. Lesson Topic Number as specified in the curriculum outline of instruction of the CCD.
d. Date of preparation.
e. Topic title as specified in the curriculum outline of instruction of the CCD.
f. Time breakdown is the time allotted for completion of the individual lesson, in contact periods (total, classroom, and laboratory) as specified in the curriculum outline of instruction of the CCD.
g. References for all source material from which the instructor is to gather information to support the LOs. Each source document should be identified by title, page, and paragraph number.

h. LOs should list both TLOs and ELOs (in the order they are taught) as specified in the curriculum outline of instruction of the CCD.
i. Teaching points should include all key points of the presentation that support each ELO.
j. Equipment required for the instruction should list all equipment necessary to conduct the lesson in the sequence used.
k. Instructional aids required by the instructor to present and conduct the lesson topic, such as, publications, wall charts, transparencies, slides, etc. Materials should be listed by type and identification number.
l. Testing requirements should include a summary of the testing strategy for the lesson topic.
m. List of supporting papers.
n. Supporting papers.
o. Student instructional materials.
p. Multiple instructor requirements.
q. Instructional guidance.
r. Classroom, training area, range requirements.
s. Ammunition requirements.
t. Safety precautions related to the course.

8.4.2.2.2 Introduction. This step should be developed to promote student interest, to motivate each student with a desire to gain an understanding of the lesson topic, and to enable each student to recognize ELOs and their relationship to the TLO. The introduction may consist of:

a. An overview that should provide a brief description of the material to be learned.
b. A motivation statement that should explain how and why the material to be learned is important.
c. A statement of the LOs to identify what students are to do and convey the testing strategy.
d. Safety precautions related to the lesson.
e. A review of materials previously presented and related to the new lesson topic.

8.4.2.2.3 Body. The body should provide new instructional material sequenced to ensure the maximum transfer of knowledge. It should provide the details necessary to support the efforts of newly assigned instructional personnel. The body may consist of:

a. Presentation.
b. Discussion points/outline of instruction as follows:

(1) All lesson material should be covered here. The main or key points of the step should correlate with the ELOs. These points should be presented in sufficient detail to ensure thorough and complete coverage of all LOs.

(2) During development, adequate spacing should be provided between discussion points to allow for instructor personalization. The first discussion point should list any safety precautions related to the lesson topic. For lesson topics that include labs involving equipment, the first discussion point should also include a review of training time out procedures.

c. Learning activities.
d. Application.
e. Evaluation.
f. Intermediate summaries as required.
g. Media cues.
h. Help.
i. Questions that should be designed to help the instructor gauge student comprehension of the lesson topic material.
j. Answers to questions.
k. Practice.

8.4.2.2.4 Conclusion. The conclusion should provide a summary of the lesson topic material and may consist of:

a. Review/summary.
b. Assignments for the student.
c. Transition information necessary to proceed to the next topic.
d. Test/evaluation of LOs.
e. Critique of course (if applicable).

8.4.3 Trainee guide answer keys. The answer keys should provide answers to questions in the associated trainee guide for the instructor's use.

8.5 Develop tests. After developing the lesson plan, the next task is to develop tests to assess the student's attainment of the LOs. To ensure that tests adequately measure the LOs, the performance required in the test should match the performance required in the LO. Remember, test items were developed after the LOs were written (see 7.7).

8.5.1 Purpose. The primary purpose of testing is to assess the student's attainment of the behavior specified in the LO. Tests can also serve several other purposes such as those noted in Table 31.

TABLE 31. **Types of tests**.

TEST CATEGORY	PURPOSE OF TEST
Criterion	• Used to measure the student's attainment of the objective. • Used to measure the effectiveness of the instruction.
Pretest	• Used to measure the student's ability to attain each objective. • Used after the instructional system becomes operational to determine how much instruction individual students need.
Diagnostic	• Used to determine attainment of supporting knowledge and skills necessary to perform the TLO. • Used during validation to predict success, to identify and correct weaknesses in the instruction.
Survey	• Used to determine what prospective students already know and can perform before receiving instruction. • Used during development of instruction to gather data for design of instruction.

8.5.2 Characteristics of tests. There are several characteristics to be considered when developing tests. These characteristics ensure that the tests measure what is intended each time they are administered. The characteristics are shown in Table 32.

TABLE 32. **Characteristics of tests**.

CHARACTERISTIC	DEFINITION
Validity	• Degree to which the test measures what it is intended to measure. • Degree to which the test predicts performance.
Reliability	• Degree to which the test yields the same results consistently. • Consistency across two administrations to the same students. • Consistency across two forms of the same test.
Usability	• Tests that are easy to administer, score, and interpret.

8.5.3 Assessment method. Most tests can be classified into two main groups: predictive and performance tests. A common question is: When should designers use performance tests and when should they use question-answer tests? These are the wrong categories for comparison. The comparison should really be between performance tests and predictive tests.

8.5.3.1 Performance test. A performance test is one in which the student actually performs the skill required by the TLO. Many concept and rule-using type performances are tested with paper-and-pencil tests. For instance, many problem-solving skills involving the use of scientific principles can be observed from written performance tests. Many types of tasks, especially

equipment operation tasks, involve many different capabilities that have to be performed in an integrated manner. For example, the task of bleeding a hydraulic brake system involves recall of a procedure (cognitive skill), physical performance of the steps (psychomotor performance), recognition of the parts and tools (knowledge), observation of the brake fluid conditions in the system (cognitive skill), and cleanliness and safety (attitudes). In these types of tasks, full task performance cannot be measured by a paper-and-pencil test. A performance test would require a real or operational mock-up of a brake system. Performance tests require the student to demonstrate mastery of the task previously learned.

8.5.3.2 Predictive test. Performance tests of integrated tasks are generally time-consuming because they often have to be conducted one-on-one with real equipment or simulators. If the actual behavior cannot be tested in a performance test (because it is too costly, dangerous, or impractical), the next best option is a synthetic performance based test. The object of this type of performance test is to simulate as closely as possible the performance or portion of performance a student would be expected to perform on the job. For example, if a student can appropriately respond to visual and auditory cues in a computer based test there is a better probability that the student will be able to transfer the behavior to the actual task.

8.5.3.3 Knowledge based testing. Knowledge based testing is not normally considered predictive of job performance. It may however be useful when the object of the test is to determine that an individual has learned facts.

8.5.4 Test construction factors. Several key factors should be considered when constructing tests, such as:

a. Testing level. The level of testing (perform, comprehend, etc.) should correlate with the stated learning level for that portion of the instruction being tested - no higher and no lower.
b. Test length. Adequate coverage of the LO is the major factor in determining the length of test that is required. One or more test items may be needed to adequately measure each LO.
c. Arrangement of test items. Test items should cover the most essential and significant portions of the material. Test items should be clear, concise, and well written to minimize misunderstandings. Items of the same type should be grouped together in a test, if possible. Individual test items should also be arranged in approximate order of difficulty, which allows the students to progress as far as they can without spending excessive time on difficult items at the first part of the test.

8.5.4.1 Determine constraints at testing sites. Constraints are limiting or constraining conditions or factors. These constraints can affect all testing decisions. Identify specific constraints (by LO) which may include:

a. Time available.
b. Manpower available.
c. Costs of alternatives.
d. Equipment, tools, and materiel required/available.
e. Potential for equipment damage.
f. Facility/testing area required/available.
g. Acceptable degree of realism.
h. Logistical support required/available.
i. Supervisory requirements.
j. Adequate supervisors available.
k. Communications required/available.
l. Ethical considerations.
m. Safety considerations.
n. Environmental damage considerations.
o. Legal considerations.

8.5.4.1.1 Compare what is needed with what is available. Annotate constraints and identify potential resources for testing (by objective). Check resources such as space (i.e., facilities and ranges), equipment, tools, materials, and personnel. Determine if specific constraints apply to all LOs to be tested, a subset of LOs, or a single LO.

8.6 Develop instructional materials. During the design phase, the instructional method and media that best suits the training need were selected. During the development phase you will start to develop the media required to implement the instructional design. Developing instructional materials is a time-consuming and exacting task. Regardless of the media selected, it is essential to develop a quality product since it is the vehicle that carries the information to the students.

8.6.1 Instructional media delivery system. The instructional media delivery system includes personnel and equipment used to aid in the teaching-learning process. Some examples of media delivery systems include:

a. Instructors.
b. Print-based material.
c. Slide/tape.
d. Audiotapes.
e. Videotapes.
f. Computers/CBT.
g. Interactive video.
h. Trainers/aids.

i. Satellite.
j. Part-task trainers.
k. Simulators.

8.6.2 Factors in media development. Several factors affect the development of instructional media and materials. The relative importance of each of these factors depends on the media that has been selected. These factors are:

a. Personnel required to develop media.
b. Time required to develop media.
c. Funds required to develop media.
d. Special requirements (e.g., space photography, deep underwater photography, combat photography, hazardous materials, etc.) that involve arrangements and special approvals far beyond the norm.

8.6.3 Activities required to develop media. Development of instructional materials requires many activities to be performed. The type and number of activities depend upon the type of instructional materials being developed. Table 33 lists some common development activities.

TABLE 33. **Activities required to develop media**.

MEDIUM	DEVELOPMENT ACTIVITY	
Print	• Draft/write material. • Edit material.	• Publish material.
Transparencies	• Draft transparency. • Generate reproducible transparency.	• Reproduce transparency.
Slide/Tape	• Storyboard/script slide or tape. • Shoot and edit slide/tape.	• Narrate audio. • Print slide/tape.
Videotape	• Storyboard/script. • Shoot and edit video.	• Develop audio.
CBT	• Storyboard/script. • Develop graphics.	• Program/code computer.
Interactive Video	• Storyboard/script. • Shoot and edit video. • Develop graphics.	• Develop audio. • Program/code computer.

8.6.4 Who is responsible? Developing instructional materials normally involves teamwork and requires various skills. Curriculum developers are responsible for planning, scheduling, and ensuring the instructional materials are produced. Team members required for production of different media are listed in Table 34.

TABLE 34. **ISD/SAT development team members**.

MEDIUM	DEVELOPMENT TEAM
Print	• Subject Matter Experts. • Curriculum Developer. • Editor. • Graphic Artist.
Transparencies	• Subject Matter Experts. • Curriculum Developer. • Graphic Artist. • Editor.
Slide/Tape	• Script Writer. • Subject Matter Experts. • Photographer. • Sound Technician. • Editor.
Videotape	• Script Writer. • Subject Matter Experts. • Video Producer, Editor, Cameraman. • Sound Technician.
CBT	• Script Writer. • Subject Matter Experts. • Graphic Artist. • Computer Programmer.
Interactive Video	• Script Writer. • Subject Matter Experts. • Video Producer, Editor, Cameraman. • Graphic Artist. • Sound Technician. • Computer Programmer.

8.6.5 Guidelines for developing materials. When developing instructional materials, make sure they:

a. Support the LOs.
b. Are student-centered.
c. Meet the design that was specified in the design phase.
d. Use techniques that are consistent with the principles of effective learning.
e. Are appealing to the students.
f. Are constructed so students will be attentive. This can be done by making the material interesting and meaningful to the students.

g. Require the student's attention. One way to accomplish this is to require specific responses or actions.
h. Lead students in the direction of the behavior specified in the LO and guide them toward mastery of the task. With the proper stimuli and reinforcement, the desired student behavior can be shaped.
i. Are developed using experts such as programmers, photographers, graphic artists, script writers, and editors in order to develop quality instructional materials.
j. Are checked for technical accuracy, completeness, programming errors, and blurred slides prior to publication or production to ensure quality.
k. Contain the appropriate level of vocabulary for the target audience.
l. Are properly paced; not too fast or too slow.
m. Are easy to understand.
n. Include the appropriate safety precautions.

8.7 Update ISD/SAT evaluation plan. An evaluation plan is a "metric" or standard for evaluation of the ISD/SAT process and products. It is developed initially in the planning stage and updated through the analysis and design phases. To ensure that the evaluation plan is effective throughout the life cycle of the project, it should be updated during the development phase.

8.7.1 Assessing quality. The ISD/SAT evaluation strategy should include procedures for evaluating the development phase and its products to assess the overall quality. A good method for assessing quality is to develop a job aid. There are other ways but they may not be as easy to develop and use. One of the simplest ways to develop a job aid is to use a series of questions such as the following.

a. Does the ISD/SAT evaluation strategy, for the development phase, assess both process and product quality?
b. Are the quality standards for the development phase realistic and adequate?
c. Can the development process be improved? If so, how?
d. Can the products of the development phase be improved or simplified? If so, how?
e. Are the various products of the development phase accurate and do they agree with other products of this phase? For example, do the LO, training standard, plan of instruction, lesson plan, and student materials all agree?
f. Are there any products in the development phase that are not needed?
g. Are there additional products that should be developed?

8.7.2 Why update the evaluation plan? Each time an ISD/SAT project is started an ISD/SAT evaluation plan or strategy should be developed. The strategy used to evaluate the various ISD/SAT projects will likely be different since most ISD/SAT projects are different. For example, in some ISD/SAT projects training to be delivered may be developed by an instructor.

In other cases, computer based training may be developed to be exported to the field. For this reason, it will be difficult to develop an evaluation strategy during the initial planning stages that does not require updating. To effectively evaluate the entire ISD/SAT process, periodically update the evaluation strategy to keep it current, reflecting the actual status of the evaluation process. Updating the strategy will not only keep the development effort on course but will also ensure quality.

8.7.3 What should be updated? The ISD/SAT evaluation plan should be updated periodically so that it remains an effective management and evaluation tool. Update the ISD/SAT evaluation plan to include new or revised information such as:

a. Changes in the evaluation strategy for the development phase. For example:

   (1) Types of products to be evaluated such as instructional materials, lesson plans, and ICW.
   (2) Procedures to be used in evaluating the development process and products.
   (3) Standards or metrics to be used in the evaluation.

b. Revisions to the evaluation schedules such as:

   (1) Quantity of products to be evaluated.
   (2) When the development process and products will be evaluated.

c. Documentation of results of the development phase.
d. Rationale for changes made to the ISD/SAT evaluation strategy during the development phase.
e. Lessons learned during the evaluation of the development phase.

8.8 Tracking the quality process. The quality process is an important part of ISD/SAT. The quality process is documented to the point that it is traceable throughout the life cycle of the project. Document only what is necessary, and no more.

8.8.1 Quality and validation. At this point in the instructional development process, LOs have been developed, tests written, instructional methods and media selected, and instruction is being developed. Yet, there is no assurance the instruction will be effective. Therefore, the instruction should undergo validation to prove that the instruction provides graduates with knowledge, skills, and attitudes to meet job performance requirements. If deficiencies are found in the instruction during validation, they are corrected before course implementation. Validation consists of technical accuracy review, individual tryouts, and small-group tryouts which are conducted as a part of formative evaluation and operational (field) tryouts which make up summative evaluation.

8.8.1.1 What is validation? Validation assesses the effectiveness of instruction while it is being developed with the intention of improving it. It is a process of repetitive cycles of development, tryouts, and revisions until evidence shows that the instruction is effective.

8.8.1.2 When should validation be done? When possible, validation is done as segments, units, or blocks of instruction are developed or revised. It is best for instructional developers and instructors to wait until all of the instruction has been developed before determining its effectiveness.

8.8.2 Develop validation plan. For a training system to be effective, adequate planning should take place in the initial stages of training development. A part of that planning is the evaluation plan which often includes a plan of how the instruction is to be validated. These plans can be separate or can be subsets of other plans. Validation planning is essential for successful implementation of an instructional system.

8.8.2.1 Purpose. A validation plan provides instructional developers and instructors with a "road map" for validating the instruction. A validation plan provides organization and creditability to the validation process.

8.8.2.2 What is in a validation plan? Validation plans may contain information such as:

a. Description of instruction to be validated (e.g., LOs, method, media, etc.).
b. Who may conduct the validation.
c. Validation procedures.
d. Validation schedules.
e. Program schedule constraints.
f. Number of tryouts to be conducted in each of the tryout activities.
g. Number and availability of students to be used in the tryouts.
h. Sources and how the results should be documented.
i. How problems should be resolved.

8.8.2.3 Getting ready to validate. Prior to starting validation:

a. Understand each activity in the validation process.
b. Know who is expected to conduct the various activities.
c. Know when the activities are to occur.
d. Ensure that the training is ready.
e. Ensure that students have been scheduled.
f. Know how to document any deficiencies.
g. Know procedures for revising training, if applicable.

8.8.2.4 How to use a validation plan. Using the plan, those validating the instruction follow the predetermined guidelines and standards for evaluating the effectiveness of the instructional system under validation. Using the plan also provides organization to the process and adds credibility by providing a documented process.

8.8.2.5 Measure against a standard. Each component of the instructional system is measured against a predetermined standard. If components of the system do not meet the criterion/standard, then an analysis of the component(s) should be conducted to determine why they do not meet the established standard. First, determine if the standard is realistic and valid. If so, then examine why the established standard is not being achieved. For example, a majority of the students are unable to accomplish a specific performance task in the time specified. A check of the technical data and with Subject Matter Experts (SMEs) indicates that the standard is correct. A further analysis of the lesson plan reveals that the task procedures are being taught incorrectly, thus causing additional time to be needed to complete the task. Validating each component of the instructional system against standards established in the plan allows those components not meeting standards to be identified and corrected as necessary, thus ensuring the quality and effectiveness of the instructional system to be maintained.

8.8.2.6 Follow the plan. Following the established guidelines in the validation plan ensures that the validation of the instructional system is performed in an organized, timely manner with each component of the instructional system being validated at the appropriate time in the process. For example, the plan identifies each component of the instructional system, how each component will be validated, when each component will be validated, and the standard to be used in the validation process. The plan also serves as the basis for reporting results of the validation process.

8.8.3 Conduct technical accuracy reviews. The technical accuracy review, which is a formative evaluation activity, is the first step of the actual validation process. This review identifies inaccuracies and weaknesses in the materials under review. Materials should be thoroughly reviewed, since this may be the last opportunity to revise draft materials before they are tried out on the students. If possible, and when applicable, conduct technical accuracy reviews each time instruction is developed, updated, or revised. Technical accuracy reviews may be conducted by:

a. SMEs.
b. Instructional developers.
c. Instructors.

8.8.3.1 What should be reviewed? Instructional materials to be reviewed include, but are not limited to:

a. LOs.
b. Test items.
c. Storyboards/scripts.
d. Audiovisual materials such as slides, films, videotapes, and transparencies.
e. Job aids.
f. Printed materials.
g. CBT such as ICW, CMI.

8.8.3.2 How to conduct a review. There are many ways to review training materials for accuracy, completeness, and quality. The bottom line is to cross-check the materials against the data sources such as technical orders, regulations, directives, and checklists. One method to aid in conducting the review is to develop a job aid. An example is provided in Figure 19.

JOB AID FOR INTERNAL REVIEW	YES	NO
1. Is the content of the material accurate?		
2. Is the material current?		
3. Is the material complete?		
4. Does the sequence of the material build learning on learning?		
5. Are the practice exercises adequate?		
6. Are the review exercises adequate?		
7. Does the material/lesson effectively teach the behavior specified in the LO?		
8. Is the LO adequately evaluated?		
9. Is the content of the material compatible?		
10. Are there any "bad" parts in the material? (If "yes", answer #11.)		
11. Can the materials be improved? If YES, how?		

FIGURE 19. **Sample job aid for internal review**.

8.8.3.3 During a review. When conducting a review, the reviewers should:

a. Take careful notes while conducting the review.
b. Make specific comments.
c. Identify weaknesses in the materials.
d. Recommend ways to improve the materials.

8.8.3.4 After a review. After the review, the reviewers should:

a. Discuss their findings.
b. Determine what revisions or changes should be made to the materials.
c. Decide the best way to make the necessary corrections to the materials.
d. Make revisions and changes to the materials, as applicable.

8.8.4 Conduct individual tryouts. Individual tryouts, a formative evaluation activity, are normally the next step in the validation process. During this step, as the instruction and materials are being developed they need to be tried out on several students, if practical, in order to add validity and reliability to the data collected during the tryout.

8.8.4.1 Purpose. The purpose of individual (one-on-one) tryouts is to determine the effectiveness of small segments or units of instruction and materials as they are developed, updated or revised.

8.8.4.2 Select students. A great deal of care should be used when selecting students to participate in the individual tryouts. During the selection process, consider the following factors:

a. If students do not fall within the predetermined range, tryout results can be skewed. Thus, student performance cannot be generalized to the target audience. Students selected for the tryouts should be from the target audience and fall within the predetermined range of:

(1) Aptitude.
(2) Skills.
(3) Attitude.
(4) Prior knowledge.
(5) Background experience.

b. Include a mix of students from each range in aptitude and background.

8.8.4.3 Media use during tryout. The nature of the tryout should depend, to some degree, on the media selected for use in the course. Certain types of media selected for use in the course may be too expensive for use during the individual tryouts or may not be available. Table 35 provides examples of ways to validate the instruction and materials without having all of the media selected for the course.

TABLE 35. **Media use during tryouts.**

IF MEDIA SELECTED IS	HOW TO CONDUCT INDIVIDUAL TRYOUT
Paper-based media. Available such as job aids, simulators, trainers. Capable of being quickly and economically developed such as slides, graphics.	Use the actual media that will be used in the course during individual tryouts.
Not available, dangerous to use, or expensive to develop.	Devise storyboard versions of the instruction. For example: • Paper script can be used in place of ICW, films. • Drawings and illustrations can be used in place of ICW, slides. • Mockups can be used to replace the actual media.

8.8.4.4 Before a tryout. If instructors are involved with the individual tryouts, they should be aware of their role and the role of the student. Before conducting the individual tryouts, instructional developers should prepare the students for the tryouts. Students need to know:

a. The purpose of the tryout.
b. Their role in the tryout.
c. That they are not being evaluated; the training and material are.
d. That their active participation is essential if the individual tryout is to be successful.
e. That their feedback is necessary in determining adequacy of the training and materials.

8.8.4.5 During a tryout. Sources of individual tryout information are provided in Table 36. During the individual tryouts, instructional developers should:

a. Closely observe students as they use the material.
b. Make careful note of where students seem to have problems or uncertainties.
c. Give assistance to students only when it is essential to student progress.
d. Administer the relevant test item at the appropriate time.
e. Get the student's view about the difficulties encountered during the tryout.

TABLE 36. **Sources of individual tryout information.**

SOURCE	ACTIVITY/INFORMATION
Diagnostic Tests	• Administer pretest to identify entry behavior. • Administer post-test to assess learning as a result of the tryout.
Student Performance During Learning	• Observe and record student's performance. • Determine which exercises or tasks result in errors; types of errors; how many students are making the same error(s).
Student Comments	• Get student reaction to the instruction and materials, especially their difficulties. • Ask students for suggestions on how the instruction and materials can be improved.

8.8.4.6 Typical problems. Often, when conducting individual tryouts, problems are identified that are typically found during the first tryouts. Some of the typical problems are:

a. Improper sequencing of the training.
b. Instruction not clear and concise.
c. Lack of supporting training materials.
d. Confusing test items.
e. Test items that do not measure LOs.
f. Insufficient practice time.

8.8.4.7 After a tryout. When the individual tryouts have been completed, analyze the resulting data to determine if error patterns or problems have occurred on successive tryouts. If so, changes or revisions to the training or materials may be appropriate. For example, if each student participating in the individual tryouts fails to meet the performance standard for a particular LO. Review the LO, training materials, and test, and revise as necessary. In most cases, several tryouts should be conducted before making any significant revisions or changes to the training or materials. When significant revisions or changes are required in the training or materials, it is recommended that additional individual tryouts be conducted again in order to determine if the problem was solved.

8.8.5 Conduct small-group tryouts. After the individual tryouts have been completed and all necessary revisions have been made to the training, it is time to conduct the next stage of validation, which are the small-group tryouts. In this stage, which is the last activity in formative evaluation, the training and materials are tried out on small groups of students. Up to this point, the success of the instruction has been based on a limited sampling of students with higher aptitudes. It should be pointed out that the training and materials are developed for average students; thus, small-group tryouts are focused on the average group.

8.8.5.1 Purpose. The purpose of conducting small-group tryouts is to determine if the training and materials work under conditions approximating the actual instructional environment.

8.8.5.2 Select students. Student selection for the small-group tryout is again very important in terms of validating the effectiveness of the training and materials. Students selected to participate in the tryout should be representative of the target audience. If possible, students selected should have:

a. Even distribution between low and high aptitudes. Even distribution of students helps determine if the training and materials will be effective under operational conditions.
b. Different skill levels.
c. Different backgrounds.

8.8.5.3 Number of students. The number of students included in the small groups should be determined based on factors such as:

a. Need for teams of students within the small group (for example, some tasks may require students to work in teams of two; if so, the small-group size should be based on multiples of two).
b. Planned normal group size of the operational system.
c. Availability of equipment.
d. Availability of facilities.

8.8.5.4 Time is a critical factor. To this point in the validation process, time required to perform a task has not been of major concern. However, time becomes a critical factor in the small-group tryouts. Learning the material or performing a task is not sufficient; students should be able to learn the information or perform the task within a reasonable time period. Therefore, effort should be made to develop training that can be accomplished within a realistic time period based on training requirements and the capability of average students.

8.8.5.5 Before a small-group tryout. The following should be completed before trying out training on small groups:

a. Determine number of students to be included in the small group.
b. Determine the number of groups to be used in the tryouts.
c. Select representative students from the target audience.
d. Ensure that the training and materials have been revised to include the applicable information resulting from individual tryouts.
e Ensure that student materials are available in adequate quantities.
f. Ensure that resources such as equipment, personnel, and facilities to be used during the tryout approximate the operational conditions.

g. Ensure that the instructional information management system is operating for data collecting, analysis, and reporting.

8.8.5.6 During a tryout. Do not supplement the instruction until tryout is completed. Supplementing the instruction may skew the results of the tryout. When conducting small-group tryouts:

a. Ensure that the time required for each student to complete the material is accurately recorded. This information is used to determine unit times, course length, and course content.
b. Record accuracy of student responses. This information should help determine deficiencies in the training or materials.
c. Establish the number of trials a student should be permitted to meet performance requirements.

8.8.5.7 After a tryout. As with the individual tryout, if the training or materials require significant revisions or changes, it is recommended that additional small-group tryouts be conducted again to determine if the revisions were effective. Conduct a sufficient number of small-group tryouts to ensure that the data collected is both valid and reliable. Once the data has been collected, it should be analyzed to determine:

a. Median time required to complete each segment or unit of training (this information is used to set the approximate times for lessons, segments, units, or modules of instruction).
b. Need to revise equipment requirements, make changes to facilities, and adjust personnel authorizations.
c. Training and materials requiring revisions or changes.
d. Priority for accomplishing revisions or changes and plan of accomplishment.

8.8.6 Conduct operational (field) tryouts. The operational tryout is the final step in the validation process. This evaluation activity is conducted under normal operating conditions by an instructor. Field tryouts of training may vary from a single block or module of training to an entire course. The training to be validated will depend largely on whether it is a new course or a block or two of an existing course that has been revised.

8.8.6.1 Purpose. The purposes of operational tryouts are to:

a. Determine if the training system actually works under operational conditions.
b. Provide feedback from a large sample of the target audience on which to base final revisions or refinements to the training system prior to it becoming operational.
c. Work out any implementation or operational problems, such as equipment and facilities.
d. Provide feedback from field units on quality.

8.8.6.2 Student selection. For operational tryouts, students are selected to participate from the target audience, using the normal student scheduling process.

8.8.6.3 Before a tryout. Before conducting the field tryouts, ensure that:

a. Resources such as equipment, facilities and instructors are available.
b. Training and materials have been revised based on the results of the small-group tryouts.
c. Materials are available in adequate quantities.
d. Students have been scheduled to participate in the tryouts and have been informed of their role.
e. Size of tryout class is compatible with operational conditions.

8.8.6.4 During a tryout. Conducting an operational tryout is like operating a course under normal day-to-day conditions. However, when conducting operational tryouts:

a. Ensure that instruction is conducted in the normal operating environment.
b. Collect validation data such as time requirements, test results, instructor and student comments, and problem areas.
c. Use adequate data samples to ensure valid and reliable data.

8.8.6.5 Collect data. Operational tryout data is collected before, during, and after the training is provided. The field data collection is summarized in Table 37.

a. Before conducting training, the instructional developer or instructor should:

    (1) Determine if the students have met the course prerequisites and identify their entry knowledge and skill level.
    (2) Collect data using such methods as pretests, oral examination, or by directly asking the students if they have specific skills or knowledge.

b. During conduct of training, the instructional developer or instructor should:

    (1) Identify breakdowns in the training and check student progress.
    (2) Record the duration of the training.

c. After conducting training, the instructional developer or instructor should:

    (1) Administer post-test.
    (2) Interview students.
    (3) Critique the training.

(4) Gather supervisors' critiques of graduates.

TABLE 37. **Field data collection**.

STAGE	DATA TO BE COLLECTED	DATA COLLECTION METHODS
Before	• Student entry skill/knowledge level.	• Pretest. • Oral examinations. • Student interviews.
During	• Number of errors students make. • Questions raised by students. • Student work samples. • Duration of the instruction.	• Observations. • Recording student questions. • Collecting work samples. • Written test.
After	• Student learning gains. • Student views of the instruction, materials. • Supervisor's critique.	• Post-test. • Student interviews. • Student critiques. • Supervisor critiques

8.8.6.6 After a tryout. As with other forms of validation, continue to tryout, and revise as long as the quality of the training system is improved. When adequate numbers of operational tryouts have been conducted:

a. Analyze the data gathered during the tryouts.
b. Revise the instructional system as necessary.
c. Gather feedback from field on quality of course graduates.

8.8.7 Finalize training materials. After validating the training, finalize the training materials. During this step, make sure that all necessary changes are made to the training materials and they are ready for implementation.

8.8.7.1 Purpose. The purpose of finalizing the training materials is to ensure that they:

a. Have been revised to include the most current and accurate information.
b. Are complete.
c. Are ready to use in the instructional environment.

8.8.7.2 What needs to be updated? When finalizing training materials, update:

a. Plans that have been developed.
b. Course control documents.
c. Training materials.

8.8.7.3 Quality checklist. Table 38 provides a list of questions that may help ensure that everything is ready for implementation.

TABLE 38. **Quality checklist.**

TRAINING MATERIAL	QUESTIONS
Training Plan	• Has the training plan been updated? • Is the training plan complete? • Has the training plan been approved? • Have the training plans been distributed, as required?
Training Standard	• Has the training standard been revised/changed? • Has the training standard revision/change been approved? • Has the training standard been approved?
Plan of Instruction	• Has the plan of instruction been updated? • Is the plan of instruction complete? • Has the plan of instruction been approved? • Has the plan of instruction been published and distributed?
Instructional Materials	• Printed Materials: •• Have the student workbooks been updated? •• Are the student workbooks complete? •• Have the student workbooks been published? •• Have the instructor lesson plans been updated? •• Are the instructor lesson plans complete? •• Have the instructor lesson plans been approved and published? • Audiovisual: •• Have the transparencies been updated? •• Are the transparencies complete? •• Are the transparencies ready for use? •• Have the slides been updated? •• Are the slides complete? •• Are the slides ready for use? • Interactive Courseware: •• Has the program been updated? •• Is the programming complete? •• Has the ICW been operationally tested?

9. ISD/SAT IMPLEMENTATION PROCESS

9.1 General. Before putting the course "on-line," ensure the system functions are in place, instructors and supervisors are prepared to conduct and administer the training, and all of the required resources (i.e., personnel, equipment, and facilities) are available. Once the course becomes operational, ensure that the system continually receives the necessary support and maintenance. Also, periodically conduct an operational evaluation to ensure the course continues to operate effectively and cost-efficiently and produces graduates that can meet the job performance requirements. The implementation phase begins after training has been designed

and developed. Figure 20 depicts the ISD/SAT model with the implementation phase highlighted.

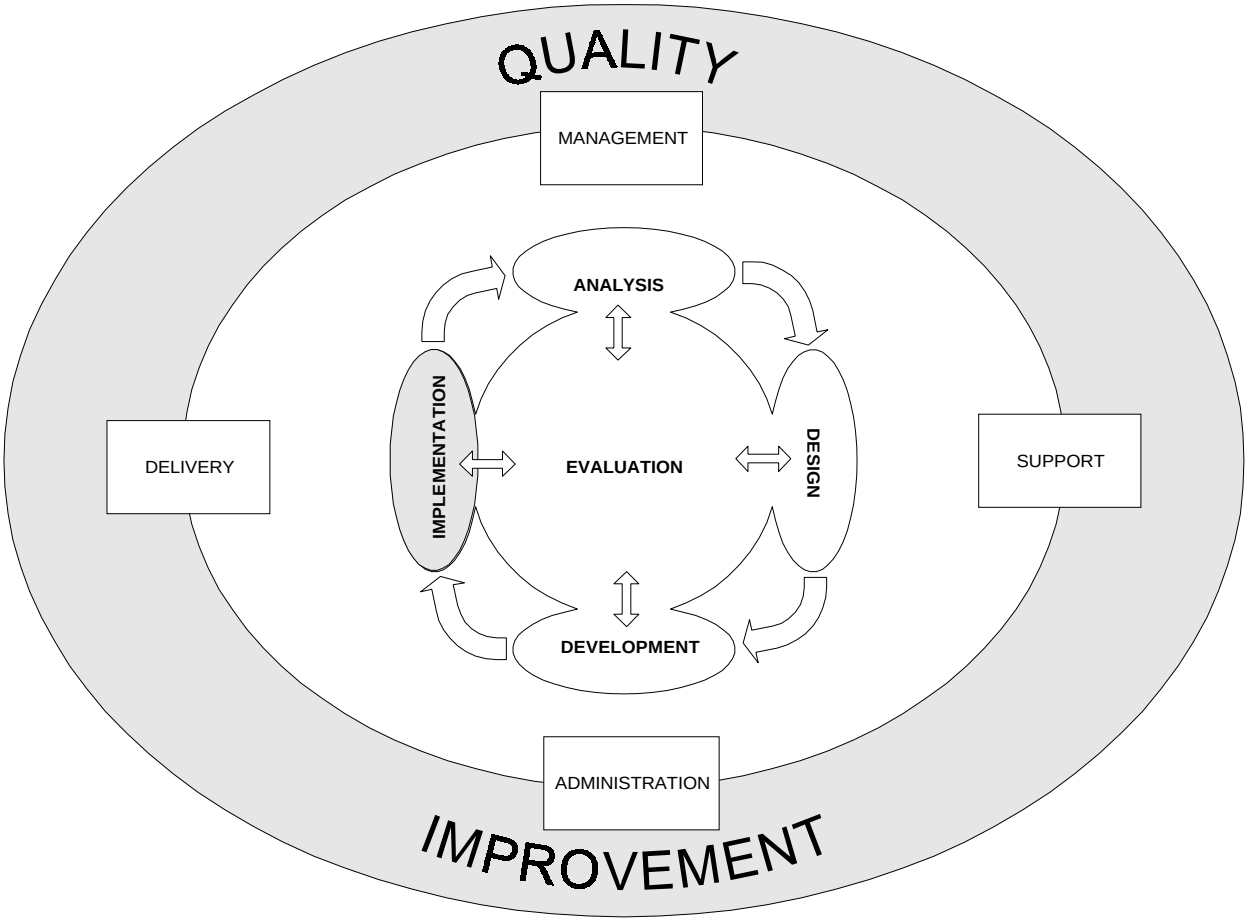

FIGURE 20. **ISD/SAT implementation phase.**

9.2 Implement training system functions. In most formal training environments, it will not be necessary to implement the training system functions, which were likely implemented when the training organization was established. Ensure that these functions are being performed by someone in the training organization. It is important to clearly understand how the system functions interface with the training system to support, operate, and maintain the system. System functions can be divided into management, administration, support, and delivery. This section discusses each of these functions.

9.2.1 Management function. Competent management is key to an effective training system. Management has the overall responsibility for ensuring that all components of the training system are fully integrated and compatible. The effective manager constantly monitors the

system to detect and correct problems that can hamper system efficiency. No matter how carefully the planning was performed, training can be inadequate if management fails to perform its functions.

9.2.1.1 Who is responsible? It is often thought that only supervisors or managers have management responsibilities, but that is not the case within the training organization. Each individual within the training organization has certain management responsibilities. For example:

a. Instructors manage the instructional/learner activity.
b. Instructors' supervisors manage the scheduling of courses and make sure that instructors are available and properly trained.
c. Instructional developers manage development of the instruction.
d. Development branch chiefs manage the training development process to ensure that effective, cost-efficient training is developed in a timely manner.
e. Managers manage the overall training programs to ensure they are meeting the users' needs. Table 39 provides examples of activities performed by management in support of the training system.

TABLE 39. **Examples of activities performed by management.**

ACTIVITY	SAMPLE TASKS
Planning	• Develop the management strategy for the training system. • Make long-range management plans. • Develop a plan to manage training development projects. • Plan for system resource requirements including time, equipment, personnel, facilities, and maintenance. • Plan quality improvement program to include formative, summative, and operational evaluations. • Plan certification of instructors and instructors' supervisors and continuation training programs to ensure qualification of the instructional staff.
Organizing	• Establish lines of communications between the development team and management to enhance the development effort. • Organize and schedule resources to support the development effort.
Coordinating	• Establish lines of communication with supporting organizations, such as resource management, civil engineering, and logistics to ensure availability of resources. • The Training Manager, as the command-level representative, secures commitment from the using command to provide training management oversight funding for the life of the system including annual reviews.

TABLE 39. **Examples of activities performed by management - Continued.**

ACTIVITY	SAMPLE TASKS
Evaluating	• Monitor established milestones, budget expenditures, and development progress against what was planned. • Evaluate the process and products of each phase of the ISD/SAT process for quality. • Review training and materials for accuracy, currency, and availability.
Reporting	• Provide briefings on status of courses and course development projects to individuals such as planning managers and commanders. • Report inspection and evaluation results such as course reviews, self-inspections, course validation, and summative evaluations. • Report any identified training deficiency or supply difficulty.

9.2.1.2 Management activities. The management function is the practice of directing or controlling all aspects of the training system from the initial project planning to day-to-day training. The training system management function includes:

a. As the command-level representative, secures commitment from using command to provide training management oversight funding for the life of the system including annual reviews.
b. Planning for the design, development, implementation, support, operation, and maintenance of the training system.
c. Organizing the resources, which involves identifying, arranging, and bringing together personnel, equipment, facilities, etc., required for the training system.
d. Coordinating activities between the training and supporting activities such as civil engineering, resource management, and services.
e. Evaluating the effectiveness and cost-efficiency of each element of the project such as personnel, milestones, budget, and production.
f. Reporting status and progress of the project to management and other organizations involved.

9.2.1.3 Relationship to implementation. Every aspect of the instructional system depends on the instructional system management function. Its planning, organizing, coordinating, evaluating, and reporting activities all work toward ensuring the successful implementation of an instructional system. Without this function, the instructional system could be ineffective and inefficient.

9.2.2 Administration function. Often overlooked, the administration function plays a vital role in the day-to-day operation of an instructional system. Management may be doing an excellent job managing an instructional system and the training staff may be outstanding in providing instruction. But, if the administration function is not working, the instructional system suffers. When not directly involved in any administrative activities it is important to be aware of what is being done on a daily basis by other organizations to support and maintain the instructional system.

9.2.2.1 Administration activities. Various training support organizations have their own individual administration responsibility. Administration includes activities such as:

a. Providing administrative support for documents such as training standards, plans of instruction, lesson plans, and student workbooks.
b. Maintaining personnel, training, and equipment records.
c. Producing reports, letters, and messages.
d. Performing student support, which includes tasks such as processing of students.
e. Administering staff support tasks such as leave process, preparation and maintenance of personnel records, and administration of personnel programs.
f. Scheduling resources such as programming of the annual student throughput, scheduling students for classes, and establishing equipment utilization schedules.
g. Tracking students and equipment.

9.2.2.2 Relationship to implementation. The instructional system administration function should be "in place" before successfully implementing an instructional system. For example, the instructional materials must be produced and available, students must be scheduled and tracked, and the health and welfare concerns have to be addressed.

9.2.3 Support function. The importance of the support function in the instructional system cannot be over-emphasized. An outstanding course may be designed, developed, and implemented, but without the necessary support, it will not be effective or cost-efficient. In most cases, the support function already exists. The structure is there, "networks" have been established, and training support activities are actively supporting the instructional systems. Although the structure is there, each time an instructional system is developed the support requirements for that specific course must be established. For example, a base has several courses that require seven technicians to maintain the training equipment. If a new course is developed, the additional maintenance support requirement may drive an additional maintenance authorization. Therefore, each time a new course is developed or an existing course is revised, ensure that all support requirements are identified and adequately supported.

9.2.3.1 Definition. The support function can be defined as long-range, and day-to-day, tasks performed by training support organizations required to implement, operate, and maintain an instructional system. Examples of support functions are:

a. Maintaining equipment and facilities.
b. Supplying equipment parts and materials for the courses.
c. Providing services such as engineering, visual, and publication.

9.2.3.2 Support activities. Some of the basic support activities include:

a. Supplying equipment, parts, and materials.
b. Maintaining equipment and facilities.
c. Providing instructional materials.
d. Constructing instructional aids and facilities.
e. Providing funding and services.

9.2.3.3 Training support tasks. Various support organizations perform many tasks in support of the instructional system. Examples of training support tasks are provided in Table 40.

TABLE 40. **Training support tasks**.

ORGANIZATION	EXAMPLES OF TASKS
Civil Engineering	• Constructs training and support facilities (e.g., classrooms, test pads, etc.). • Modifies existing facilities such as adding new electrical outlets and air conditioning.
Resource Management	• Provides human resources (e.g., instructors, maintenance personnel, etc.). • Manages training and support equipment. • Provides funding for day-to-day operation.
Information Management	• Edits instructional material (e.g., student workbooks, student study guides, etc.). • Produces instructional material (e.g., student handbooks, plans of instruction, etc.).
Contracting	• Develops contracts for maintenance and other services. • Processes local purchase forms to procure equipment and supplies.
Maintenance Organization	• Performs quality assurance inspections on training, support, and test equipment. • Performs scheduled and unscheduled maintenance on training, support, and test equipment. • Fabricates trainers and training aids.
Visual Information	• Develops and controls visual material such as slide and film strips. • Manages audio-visual equipment.

9.2.3.4 Relationship to implementation. Implementing an instructional system requires a great deal of planning and preparation. A part of that effort is to ensure that the necessary

support functions are available. Without necessary support it will not be possible to operate the instructional system.

9.2.4 Delivery function. During design and development of the training system, take special care to ensure that the appropriate instructional delivery method is selected and is ready to function when it is time to implement the training. The delivery function, like the other two functions, is also critical to the training system.

9.2.4.1 What it is. The delivery function is defined as the means or methods by which training is provided to the students. Examples of delivery functions include:

a. Instructors.
b. Computers (that includes ICW, CAI, and CMI).
c. Trainers including simulators, part-task trainers, maintenance trainers, and mockups.
d. Satellites.
e. Programmed text.
f. Career development and specialized courses.
g. Job aids.
h. Network (i.e., Internet, intranet, and extranet).

9.2.4.2 Ensuring readiness. At this point, the delivery function should be fully developed and operational. Validation will have given an indication of the suitability and readiness of the instructional delivery system. Prior to implementing the instructional system ensure that everything is ready. Answer the following questions about the delivery function to determine readiness for training:

a. Are there adequate instructors to support the training requirements?
b. Have the instructors been qualified, and are they certified to deliver the instructions?
c. Are the student workbooks printed in adequate numbers?
d. Is the necessary equipment available and operational, such as computers, projectors, and simulators?
e. Has the programming of the ICW been completed?
f. Have slides and/or transparencies been produced?
g. Has the network infrastructure been established (Internet Provider (IP), computers with modems, software, LAN/WAN))?

9.2.4.3 Relationship to implementation. Simply stated, without the delivery function training cannot be implemented.

9.3 Planning for the conduct of instruction. Up to this point, managers have spent considerable time planning the instructional system, securing resources, managing the

development process, and arranging for system support. Instructional developers have analyzed the tasks, designed the instructional system, and developed and validated the instruction. The point of training implementation has now been reached. During implementation, management continues to plan and manage the instructional system; instructional developers monitor and refine instruction as necessary; the instructional staff conducts and evaluates the instruction; instructional evaluators periodically conduct operational evaluation; and the support personnel continue to support and maintain the instructional system.

9.3.1 Preparations for conducting instruction. Preparing to conduct instruction starts with the initial planning for the instructional system and continues throughout the analysis, design, and development phases of the ISD/SAT process. Because of poor planning and lack of adequate preparation, the conduct of training has often been viewed as a difficult task. However, with proper planning and adequate preparations, there should be very few problems encountered while conducting the training. When preparing for implementation, ensure that everything is ready to support the training. Adequate preparation produces graduates who can meet their job performance requirements. Inadequate planning and preparation can result in complete failure of an instructional system. For example, if the instructors have not been qualified in the subject matter, they may not be capable of providing the training necessary for the students to achieve the LOs. Thus, the instructional system produces students who can not do the job. These checks are also a quality assessment of the development process and an evaluation of the ISD/SAT process application to this point.

9.3.1.1 What should be checked? During final preparations to conduct training, each component of the instructional system should be checked "one last time" to ensure that everything is ready. Some components to be checked are:

a. Equipment:

(1) Training, support, and test equipment should be available in adequate numbers and in operational condition.
(2) Logistics support, including maintenance and spare parts, should be available for all training equipment, support equipment, and test equipment.
(3) A backup system is available if the primary system is unavailable or not usable.

b. Facilities:

(1) Training and support facilities should be available.
(2) Modifications to facilities (i.e., electrical and air conditioning) should be complete.
(3) Student support facilities should be available and adequate.
(4) Alternative facilities should be available to support "backup" system, as needed.

c. Human resources:

(1) Adequate personnel must be available including instructional developers, instructors, maintenance personnel, students, etc.
(2) Instructors and instructors' supervisors must know their importance and role in the training system.
(3) Instructors must be qualified and certified to teach the courses.
(4) Instructors must be assigned to classes.
(5) Maintenance personnel should be properly trained.
(6) Students must be scheduled for the classes.

d. Funding:

(1) Adequate funds should be available to meet implementation cost and the cost associated with daily operation of the course.

e. Time:

(1) Instructional developers should have had adequate time to develop effective and efficient training to meet the users' need date.
(2) Instructors should have enough lead time to get certification.

f. Materials and supplies:

(1) Instructional and student materials should be available in adequate quantities to support training.
(2) Training and office supplies should be available in adequate quantities to support training implementation.

9.3.2 Conducting the training. Once the instructional system becomes operational, it will remain so until there is no longer a need for the training. When conducting training, make sure the system continues to operate effectively and cost-efficiently, producing graduates who can meet job performance requirements. During the operation of the instructional system, there are ongoing activities that ensure system integrity, they include:

a. Resource management is probably the single most critical issue for training managers as well as instructors. Manage resources by ensuring that:

(1) Instructors' supervisors schedule students for training in a timely manner to ensure that students do not remain in an ineffective status any longer than necessary. Instructors, when not in the classroom, should be scheduled to work on course-

related items such as developing test items for the test pool or posting changes to technical orders used in their units or blocks of instruction.

(2) Managers ensure that equipment is available, in adequate quantities, and in an operational condition. Unneeded equipment should be turned in to supply or returned to the lender if it was borrowed.

b. Staff development is an activity that goes on continually while training is being conducted. There is always someone who needs to attend a staff development course. For example, instructors and supervisors must periodically attend courses such as "Test and Measurement", and "ISD/SAT". These courses, as well as others, continue to help the staff to develop professionally.

c. Conducting training is the centerpiece of system integrity. No matter what has been done to this point, the instructional system can fail or be rendered ineffective or inefficient if the training is not properly conducted. There are many items that will help with the conduct of training including:

(1) Training should always be student-centered. Never allow the training to be focused on the instructor.

(2) Instructors are not allowed to change the training. They must follow the plan of instruction.

(3) Instructors must always perform professionally in the teaching-learning environment. For example, instructors should be willing to assist students when necessary and within limits.

(4) Instructors should always be qualified to instruct and be certified in the units/blocks they are assigned to teach.

d. Evaluation maintains the quality of the training system. During the conduct of training, operational evaluation is continually performed to ensure the quality of the training system.

10. ISD/SAT EVALUATION PROCESS

10.1 General. Evaluation is integrated throughout each activity of the instructional development process. It starts in the planning stage with development of an evaluation plan and continues for the life cycle of the training system. The focus of evaluation is continuous improvement in training system quality.

10.1.1 Evaluation process flowchart. The operational evaluation portion of the training development flowchart is provided in Figure 21 as a quick reminder of the activities involved in the operational evaluation process.

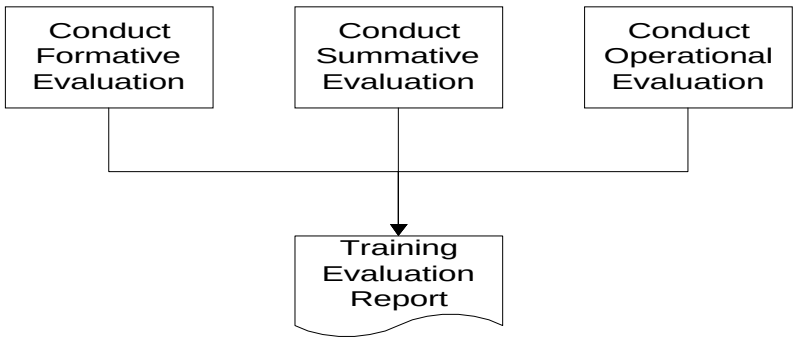

FIGURE 21. **Evaluation flowchart.**

10.2 Formative evaluation. The formative evaluation process begins during analysis and continues through small-group tryout in the development stage of ISD/SAT. Within each stage - analysis, design, development, and implementation - formative evaluation seeks to improve the quality of the processes and products of ISD/SAT. In some organizations, formative evaluation is equated to four stages of validation - technical accuracy reviews, individual tryouts, small-group tryouts, and operational tryouts. Formative evaluation is a form of evaluation designed to collect data and information that is used to improve the processes and products of the ISD/SAT process while the system is still being developed. Formative evaluation is also used when the design or development phases are reentered to update or revise the system.

10.2.1 Formative evaluation activities. Formative evaluation includes the following activities:

a. Process evaluation, ensures quality in the analysis, design, and development activities. It checks each activity against standards, or metrics, established during ISD/SAT project planning, to ensure process quality, while continually seeking improvements within each

activity. Process evaluation enables instructional developers to "form" an effective and efficient training system based on quality principles.

b. Product evaluation, is an integral part of each stage of the ISD/SAT process. Product evaluation focuses on the products of the analysis, design and development activities such as task lists, LOs, tests, plans of instruction and training materials. During product evaluation the focus is again on quality. Products are measured against standards and metrics established in the planning stage of ISD/SAT to ensure quality. Product evaluation also helps form a total quality training system. Two activities of product evaluation are:

    (1) Validation, takes place during training development and is the final activity in the formative evaluation process. This component forms the training system by trying out instruction on individuals and small groups when possible and if applicable. Validation identifies quality improvements that should be made to the instruction prior to implementing the system.
    (2) Quality control, starts in the initial stages of ISD/SAT, and continues throughout training analysis, design and development. This process ensures that each activity such as equipment acquisition, facility construction, etc., is based on quality principles.

c. Developmental Test and Evaluation (DT&E), is an active part of training system development. As a formative evaluation activity, it is conducted to demonstrate that training system equipment design and development is complete, design risks have been minimized, and the system meets performance requirements. It ensures the effectiveness of the manufacturing process, equipment, and procedures.

d. Operational Test and Evaluation (OT&E), completes the formative evaluation process for training system equipment. This formative evaluation activity evaluates the system's operational effectiveness, maintainability, supportability, and suitability. It identifies any operational and logistics support deficiencies, and the need for modification. In addition, OT&E provides information on organizational structure, personnel requirements, support equipment, doctrine, training and tactics. It should also provide data to verify operating instructions, maintenance procedures, training programs, publications, and handbooks.

e. Site Readiness Reviews, is a formative evaluation activity that focuses on evaluating the readiness of the "bed-down" site for the training system. This evaluation ensures that the site, including training facilities and support equipment, is ready for OT&E of the system. Site readiness reviews help ensure training system effectiveness.

10.2.2 Relationship of the activities. Each formative evaluation activity contributes to the overall quality of the training system. They combine to ensure that:

a. Training development and revision activities are effective.

b. Training is cost-efficient.
c. The products of each development activity meet quality standards.
d. The instruction meets training requirements.
e. Equipment satisfies operational, training, and support requirements.
f. Facilities meet operational, training, and support requirements.

10.2.3 Period of formative evaluation. Planning for formative evaluation begins in the initial planning stage of ISD/SAT. However, formative evaluation activities actually begin during analysis and continue through small-group tryout in development.

10.3 Summative evaluation. With the conclusion of small-group tryouts, formative evaluation activities are complete. Summative evaluation is the next stage in the continuous evaluation process. This stage of evaluation involves trying out the instruction on the target audience in an operational environment. In some organizations, summative evaluations are conducted after the instructional system becomes operational and include two components: internal and external evaluation. Summative evaluation is a form of evaluation designed to collect data and information during the operational (field) tryouts in order to determine the "summed" effect of the instruction under operational conditions and to make any changes or revisions to the system prior to becoming operational. Summative evaluations are also conducted when significant revisions or updates have been made to the instructional system.

10.3.1 Summative evaluation activity. The only summative evaluation activity is the operational tryouts. Operational tryouts are used to:

a. Determine if the training system works under operational conditions.
b. Provide feedback from a large sample of target audience that will be used for revisions prior to implementation of the training system.
c. Identify possible implementation or operational problems.
d. Determine if training is cost-efficient.
e. Determine if training is adequate and needed.
f. Provide validation data for acceptance testing.

10.3.2 Evaluating the integrated system. Summative evaluations are conducted on fully integrated training systems. This form of evaluation is essential in determining the effectiveness of the system and correcting any deficiencies prior to implementation.

10.3.3 Period of summative evaluation. Summative evaluation is focused on the period of operational tryouts. These tryouts begin after the small-group tryouts have been completed and continue until the training system is implemented. Normally, the operational tryout period is limited to two or three classes.

10.4 Operational evaluation. After the instruction is validated, a summative evaluation has been completed, and the system functions are in place, the instructional system is ready for implementation. Once the system is implemented and starts producing graduates, it's time to begin conducting operational evaluations. Evaluation is a continuous activity that is integrated throughout each stage of ISD/SAT, beginning with analysis and continuing throughout the life cycle of the system. Operational evaluation is a continuous process that assesses how well course graduates are meeting the established job performance requirements. Its focus is quality improvement. The last stage of the evaluation process is operational evaluation.

a. When evaluating, look for both strengths and weaknesses in the system. Focus on:

(1) How well the graduates are meeting job performance requirements.
(2) Whether training is being provided that is not needed.
(3) Whether any needed training is not being provided.
(4) How well each system component is contributing to overall system quality.
(5) Ways to improve the graduate's performance as well as the system.

b. The two operational evaluation activities are:

(1) Internal evaluation, gathers and analyzes internal feedback and management data from within the training environment to assess the effectiveness and quality of the training process. Internal evaluation data is normally gathered by the instructional developers and instructors during training.
(2) External evaluation, gathers and analyzes external feedback data from the field to assess graduates' on-the-job performance in an operational environment. Most external evaluation data is gathered by training evaluators from the organization providing the training or is provided by the graduates and their supervisors directly from the field. However, in some cases, external evaluation data is gathered and provided to the organization by inspection and evaluation teams, consultants, advisory bodies, Board of Visitors, accrediting agencies, and professional certification groups after training has taken place.

10.4.1 Internal evaluation. Internal evaluation activities begin with implementation of the instructional system and continue throughout the life cycle of the training system. Some organizations call this evaluation activity a "course review." Internal evaluations look at the training system from within to determine system effectiveness and quality. Internal evaluation is the acquisition and analysis of internal feedback and management data, such as test data, student critiques, instructor comments, and data correlation from within the training system.

10.4.1.1 Purpose. The purpose of internal evaluation is to improve the effectiveness and quality of the training system.

10.4.1.2 Possible causes of problems. Although training systems are validated prior to implementation, students may still have difficulty with the instruction during day-to-day system operation. Periodic internal evaluations may identify weaknesses (problems) as well as strengths of the training system. Possible causes of student problems are:

a. Instructors do not follow the plan of instruction/CCD or course plan.
b. The developed course is different from the course that is actually implemented.
c. Resources required to support, operate, and maintain the system are inadequate.
d. Instructional materials are not correlated.
e. Students do not meet course prerequisites.
f. Instructors are not adequately qualified.

10.4.1.3 Data collection. Several methods of collecting internal evaluation data are listed in Table 41.

TABLE 41. **Internal evaluation data collection methods**.

DATA COLLECTION METHODS	PURPOSE
Review Course Control Documents	• To determine if there are any discrepancies between the planned course and the course that was actually implemented.
Review Resources	• To ensure that facilities (training and support) are available and adequately maintained. • To ensure that equipment (training, support, and test) and supplies are available. • To ensure that human resources (instructional developers, instructors, students, and maintenance personnel) are available. • To ensure that there is adequate time (adequate course length, sufficient time to maintain the course). • To ensure that funds are adequate to support, operate, and maintain the course.

TABLE 41. **Internal evaluation data collection methods - Continued.**

DATA COLLECTION METHODS	PURPOSE
Visit Instructional Facilities	• To evaluate the quality of implemented instruction (ensure the visit is long enough to ensure observation of representative instruction). • To check equipment, instructional media, training aids and devices for condition, operation, and appropriateness. • To check instructional literature such as study guides and workbooks for quality and availability.
Evaluate Instructor Performance	• To check if instructor follows the plan of instruction, uses instructional media properly, responds to student needs, and is qualified to teach. • To check instructor evaluation forms to determine if noted weaknesses have been corrected.
Monitor Measurement Program	• To check the measurement program for compromise. If a test has been compromised, it cannot provide useful feedback. • To monitor the measurement program to ensure quality. • To evaluate training in terms of student performance. Use performance measures to determine students' achievement of LOs.

10.4.1.4 Conducting an internal evaluation. Collect sufficient internal evaluation data for the analysis. Insufficient data may skew the analysis results, possibly leading to incorrect decisions being made. Job aids can be used to gather internal evaluation data. An example of a job aid is provided in Figure 22.

JOB AID FOR INTERNAL EVALUATION		
DATA SOURCE	**YES**	**NO**
• Does the plan of instruction/course syllabus reflect the operational course?		
• Is the plan of instruction/course syllabus current and accurate?		
• Does the plan of instruction/course syllabus provide adequate guidance?		
• Do the lesson plan and plan of instruction/course syllabus agree?		
• Does the lesson plan reflect what is being taught in the course?		
• Is the lesson plan current and accurate?		
• Do training materials support the lesson plan and plan of instruction?		
• Do training facilities meet system requirements?		
• Do support facilities meet system requirements?		
• Does training equipment meet system requirements?		
• Is the training equipment adequately maintained?		
• Does support equipment meet system requirements?		
• Are instructors teaching according to the lesson plan?		
• Are instructors adequately trained to execute the courses?		
• Do tests adequately measure the LOs?		
• Is the test data thoroughly analyzed?		
• Can improvement be made in the course?		

FIGURE 22. **Example of an internal evaluation job aid.**

10.4.1.5 Student reaction. Figure 23 is an example of a questionnaire designed to obtain student feedback.

STUDENT REACTION TO INSTRUCTION

PERIOD_____ DATE_____

INSTRUCTOR_____ STUDENT_____

One way instruction is improved is by sampling student reaction to the instruction. To assist in improving this course, please answer the following questions.

1. Prior to this instruction, my experience in this area was:
_____ extensive_____ moderate _____ little or none

2. Did your knowledge of the subject increase as a result of the instruction?
_____ yes _____ no

3. If your knowledge increased as a result of the instruction, to what extent did it increase?
_____ none _____ slightly _____ moderately _____ extremely

4. Based on my experience, the level of instruction was:
_____ too advanced_____ about right _____ too elementary

5. The organization of the instruction was:
_____ very helpful _____ helpful _____ not very helpful

6. The lecture outline (main points of instruction) was:
_____ very helpful _____ helpful _____ not very helpful

7. Audiovisual aids were:
_____ of great value _____ valuable _____ of little or no value

_____ not used, but could have helped _____ not used and not needed

8. Answers to student questions were:
_____ meaningful _____ somewhat helpful _____ not helpful

_____ not applicable (no questions asked)

9. Should the subject matter covered be changed?
_____ yes (please explain below) _____ no

10. Should the method of instruction be changed?
_____ yes (please explain below) _____ no

11. Overall, the instruction was:
_____ outstanding _____ good _____ fair _____ poor

12. Instruments (including tests) to evaluate student performance were:
_____ outstanding _____ good _____ fair _____ poor

COMMENTS, EXPLANATIONS, OR RECOMMENDATIONS:

FIGURE 23. **Sample student questionnaire.**

10.4.1.6 Data analysis. Before beginning analysis of the data, ensure that:

a. Data has been collected from each component of the training system.
b. Adequate data samples are collected in order to validate the reliability of the findings.

10.4.1.6.1 Data analysis methods. The following are some methods of analyzing the internal evaluation data:

a. Compare the training standard with the plan of instruction/course syllabus to determine if the requirements of the standard are being met.
b. Compare plan of instruction/course syllabus with operational course to determine if the planned and operational courses are the same.
c. Review plan of instruction/course syllabus, lesson plans, and instructional material to determine if they are current, adequate, and in agreement.
d. Compare stated resource requirements with actual resources to determine if adequate resources are available to support, operate, and maintain the training system.
e. Review records to determine if instructors are qualified to teach the course.
f. Review test data to ensure that students are meeting course objectives.
g. Analyze test data to determine if test items are valid and reliable.

10.4.1.7 Revising the training system. After internal evaluation data is collected and analyzed, the next stage is to correct deficiencies in the training system. If revisions can be made to correct identified problems, they should be made in a timely manner in order to receive the greatest benefit from the changes. Revisions resulting from the analysis may require re-entry into an earlier phase of the ISD/SAT process to correct the problem(s). The need to re-enter an earlier phase of ISD/SAT is determined by the nature and scope of the revision. For example, changing a test item or adding time to a unit of training may not require re-entry to an earlier phase of ISD/SAT. However, adding a new piece of equipment to the course would more than likely require re-entering an earlier phase of ISD/SAT.

10.4.2 External evaluation. How well graduates meet job performance requirements is learned through external evaluation. This evaluation activity relies on input from the field to determine how well graduates are performing. External (field) evaluation is the process of gathering and analyzing data from outside the training environment in order to determine how well recent graduates are meeting job performance requirements.

10.4.2.1 Purpose. The purpose of external evaluation is to determine if recent graduates of the course:

a. Can meet job performance requirements.
b. Need all of the training they received.

c. Need any training they did not receive.

10.4.2.2 Possible causes of problems. Some possible problems that may be identified during external evaluations are:

a. Test(s) did not measure graduates' ability to meet job performance requirements.
b. LOs do not reflect job performance requirements.
c. Job performance requirements were incorrectly identified during task analysis.
d. Job performance requirements changed after task analysis.

10.4.2.3 Collecting data. Several methods of collecting external evaluation data are questionnaires, field visits, job performance evaluations, and other data sources. These methods are described in detail below:

10.4.2.3.1 Questionnaires. Questionnaires are effective, cost-efficient evaluation tools. Questionnaires are used to determine what tasks are actually being performed by graduates and the ability of recent graduates to perform specific tasks on which they received training. Questionnaires are also used to identify the specific nature of any deficiency and what training is not needed for on-the-job performance. Questionnaires have advantages, disadvantages, and are available in two types.

a. Advantages of questionnaires include:

(1) They are comparatively inexpensive to administer.
(2) They can be used to collect large samples of graduate and supervisor data.
(3) They yield data that can be easily tabulated and reported.
(4) Respondents give their opinions freely.

b. Disadvantages of questionnaires include:

(1) Developing effective and reliable questionnaires may be costly and require extensive experience.
(2) Low return rates and inappropriate responses affect accuracy.
(3) They may not be the most reliable form of evaluation; data validity depends on preparation and distribution.
(4) Communication is one-way; respondent may not understand some of the questions.
(5) Questionnaires may not ask the most relevant questions.
(6) Questionnaires collect only opinions that may not be as reliable as other methods of collecting external data.

c. Two types of questionnaires can be used to collect external evaluation data, they are:

(1) One is for the graduate's immediate supervisor. However, responding may be delegated to the graduate's trainer.
(2) The other questionnaire is for the graduate. This questionnaire is designed to find out what the graduate thinks about the training received.

10.4.2.3.1.1 Preparing questionnaires. Well-constructed questionnaires that are properly administered are extremely important to the field evaluation process. Table 42 identifies the five basic stages of questionnaire development.

TABLE 42. **Stages of questionnaire development**.

STAGE	ACTIVITY
1	• Define purpose of questionnaire. Focus only on relevant information.
2	• Determine specific information to be collected. Specify exactly what is needed in a list of LOs.
3	• Develop questions that ask for specific information such as: •• What conditions/equipment are required to perform the job. •• Exact action to accomplish the performance. •• Standards of performance. •• Results of performance.
4	• Consider motivational factors when developing questionnaires. It is important that the respondents answer fully and conscientiously. Questionnaires will likely motivate if they: •• Explain the purpose of the questionnaire. •• Tell the respondents how they can benefit from answering the questionnaire. •• Write clear and concise instructions. •• Make questionnaire format uncluttered and easy to answer. For example, using boxes for check marks should make the questionnaire easier to answer. •• Arrange the questionnaire in logical order. •• Ask specific questions.
5	• Test the questionnaire on sample respondents. Ask them to: •• Evaluate the cover letter. •• Check instructions and questions for clarity. •• Explain how they feel about answering the questions. • Revise the questionnaire, if necessary, before distribution.

a. Guidelines for developing effective questions are:

(1) Use closed-end questions when the respondent is to choose answers from a small number of possibilities. This makes tabulation easy but may not give the range of answers desired.
(2) Use open-end questions when all the possible answers are not known. The respondent will probably suggest possibilities.

(3) Word questions to the respondent's level of understanding. Use vocabulary and concepts that are easy for the respondent to understand.
(4) Limit each question to one aspect of a topic.
(5) Decide on the logical order of the questions (task order, general to specific). Each question increases the respondent's frame of reference and further establishes upcoming responses.
(6) Avoid questions that make it easier to answer one way or another.
(7) Avoid questions that show biases or exceptions.
(8) Word questions so they will not threaten the respondents.
(9) Supplemental "information-seeking" questions may be used. Such questions may ask how much time the graduate spends on individual tasks or what equipment or materials the graduate uses.

b. Guidelines for constructing questionnaires include:

(1) Provide short, concise, and specific directions for completing the questionnaire. The directions should be printed in heavy, bold type, if possible.
(2) Provide space for the respondent's name, title, organization, and location.
(3) Number the questionnaires to allow for administrative control.
(4) Allow the respondent to use the same type marking for all questions (whenever possible). For example, one of the best methods is to allow use of check marks for responses.
(5) Arrange "yes" and "no" responses vertically rather than horizontally.
(6) Number each page of the questionnaire.
(7) The questionnaire should be easy to read and mark.
(8) Print on both sides of the pages to conserve materials, if possible.
(9) Send self-addressed return envelope with the questionnaire.

10.4.2.3.1.2 Before distributing the questionnaire. Before distributing the questionnaire, it should be administered to a small number of select individuals to:

a. Provide valuable feedback on the quality of the questionnaire.
b. Preclude acquiring misinformation resulting from the administration of a faulty questionnaire.
c. Allow correction of problems in the questionnaire before distribution.

10.4.2.3.1.3 Distribution of questionnaire. Distribution of the questionnaire is a critical aspect of external evaluation; it’s not as simple as picking a few graduates' names and dropping a questionnaire in the mail to them. It is necessary to plan the distribution to help ensure a random sample so that the data collected is valid and reliable. When distributing the questionnaire:

a. Decide who is to receive the questionnaire - recent graduate, his or her supervisor, or both. Important information may be collected from both.
b. Select a representative sample to ensure valid results. Graduates may perform different tasks or their job requirements may vary depending on the major command, geographic location, or organization level; therefore, questionnaires should be distributed to each area as evenly as possible.
c. Determine how many questionnaires need to be mailed. That decision is based on:

    (1) Expected response rate.
    (2) Level of confidence (a statistical consideration which means the size of the sample required to be, for example, 95 percent sure the sample truly represents the larger population). The graduate sampling chart on the following page shows how to determine the number of questionnaires needed based on this consideration. See Table 43.

d. The cover letter for the questionnaire should explain the purpose, importance, directions for returning, the recommended return date, and a statement ensuring confidentiality of the respondent.
e. Decide when to distribute the questionnaires. Timing is critical. Usually, questionnaires should be sent to the graduates within three to six months after graduation. Beyond six months, it may be impossible to tell whether the graduate learned the skill or knowledge in the course, or on the job. If the questionnaire is sent too early, the graduate may not have had time to perform many of the tasks that were taught in the course.

TABLE 43. **Guidelines for course sampling**.

COURSE GRADUATES (DURING SAMPLING PERIOD)	SAMPLE SIZE 95% CONFIDENCE*	SAMPLE SIZE 90% CONFIDENCE	SAMPLE SIZE 80% CONFIDENCE
10	10	10	9
20	19	19	18
40	36	35	32
60	52	49	44
80	67	62	54
100	80	73	62
120	92	83	69
160	114	101	81
200	133	115	90
250	154	130	99
300	171	142	106
350	187	153	112
400	200	161	116
450	212	169	120
500	222	176	123
600	240	186	129
700	255	195	133
800	267	202	136
900	277	208	139
1,000	286	213	141
2,000	333	238	151
3,000	353	248	155
4,000	364	253	157

HOW TO USE THIS TABLE: The table can be used as shown in the following example:

Annual course production is 4,000 - 95% confidence level desired.* Estimated return rate of usable questionnaires is 85%. From the Table, 364 usable questionnaires are required. Therefore, this figure should be 85% of the questionnaires to mail out. The number of questionnaires to mail is computed as follows:

$\frac{85\%}{100\%} = \frac{364}{X}$ $\qquad X = \frac{364 \times 100}{85} = 404$ = number of questionnaires to mail

* It is recommended that the 95% confidence level be chosen. This is the confidence level commonly used in business decisions.

10.4.2.3.1.4 Data analysis of questionnaires. Begin analyzing the data when a sufficient number of completed questionnaires have been returned. In this process, the data is compiled, collated and analyzed (data from each command should be analyzed together). During the analysis:

a. Pay special attention to:

(1) Notes made by respondents on the questionnaires.
(2) Answers to supplemental questions that were included in the questionnaire.

b. Use with caution any data that contain such obvious errors as:

(1) Halo effect - indiscriminate rating of all items positively.
(2) Central tendency - indiscriminate rating of items in the center of the scale.

c. Examine the responses to ensure, as much as possible, that the information accurately reflects the opinion of the graduates and their supervisors.

10.4.2.3.1.5 Reporting the findings from questionnaires. After completing data analysis, the findings should be reported. The report should include information such as:

a. Background information on the course that was evaluated.
b. Scope of the evaluation.
c. Tasks evaluated.
d. Analysis results.
e. Recommendations.
f. Milestones for corrective actions, if applicable.

10.4.2.4 Field visits. Field visits are a very effective method of conducting external evaluations. They are normally conducted by a training evaluator, often assisted by an instructional developer or instructor. Ideally, field visits should include specialists who are familiar with the graduates' jobs. However, in most cases this is not possible due to limited TDY funds, scheduling constraints, and number and variety of graduates to be interviewed. The purpose of a field visit is to get first-hand information on the graduates' assignment, utilization, and proficiency on the job, and to validate information gained from other evaluation activities. Advantages and disadvantages of field visits are as follows:

a. Advantages of field visits are:

(1) Graduates and supervisors on the job normally talk freely.
(2) Guidance and information about the evaluation is given directly to graduates and supervisors.
(3) Information is gathered first-hand by the evaluator. Any questions or assumptions can be clarified.
(4) Field visits help validate questionnaire data.
(5) External evaluations build rapport between the training activity and the user.

(6) Additional information can be gained by observing nonverbal messages and asking leading or probing questions.

b. Disadvantages of field visits are:

(1) They are time-consuming. Travel to several different bases requires considerable time. Interviews and observations also require a lot of time if they are done correctly.
(2) The sample is limited. Since the evaluator only goes to a few bases, the number of interviews and observations conducted are limited.
(3) The cost is high. Field visits require evaluators to spend limited TDY funds to travel to the various bases.
(4) Information gathered by the evaluator can be subjective and biased.
(5) Graduates may feel they are being scrutinized.
(6) Evaluators are not always skilled at interviewing and observing.
(7) Graduates may feel intimidated by a higher ranking evaluator and rate more positively than they actually feel.

10.4.2.4.1 Field visit data collection. Evaluators should interview recent graduates and their supervisors and observe the graduates' on-the-job performance when possible. However, observations are almost useless unless the observer is familiar with the tasks being performed. Two methods of collecting data are:

a. Interviews.
b. Observations.

10.4.2.4.2 Preparing for the field visit. Visits to the field to collect evaluation data should be adequately planned. Adequate planning should ensure that useful data is gathered. To prepare for the visit:

a. Develop a list of questions to get honest, pertinent answers and to keep the discussion focused.
b. Determine the bases to be visited.
c. Establish the schedule for the visit.
d. Select the individuals to be interviewed and observed.

10.4.2.4.3 Conducting the field visit. The following are some of the tasks to be performed during the field visit:

a. Inform graduates and supervisors of the purpose of the visit. Tell them that their answers will furnish valuable information for improving the training.

b. Interview the recent graduates and their supervisors. Supervisors should know how well the graduate has performed on the job.
c. Determine graduate's proficiency.
d. Determine how the skills learned during training are being used.
e. Find out how the graduates are progressing on OJT.
f. Guide the interviews with the list of questions. (As the interview progresses, it may be necessary to add, delete, or revise questions.)
g. Take accurate and complete notes, especially on information that is freely given.
h. Have the supervisor rate the graduates' performance.
i. Observe graduates perform tasks. This may not be beneficial if the training evaluator does not have job or task knowledge. Take careful notes on the graduates' performance. After the task has been completed, ask questions to clarify actions taken by the graduate during task performance.

10.4.2.4.4 Data analysis. Data collected from interviews and observations are analyzed in the same manner as questionnaires-that is, compiled, collated, and analyzed by major command.

10.4.2.4.5 Reporting the findings. The results of the field visits and questionnaires should be combined and reported in the Training Quality Report (TQR). The information gathered during field visits is not normally used or reported independently. The analysis results of the questionnaires and field visits are compared in order to validate the findings.

10.4.2.5 Job performance evaluations. Job performance evaluations are accomplished jointly by the training activity and the using command in the operational environment. The purpose of job performance evaluations is to determine how well recent graduates meet the using command's job performance requirements. Advantages and disadvantages of job performance evaluations are as follows:

a. Advantages of job performance evaluations are:

(1) Evaluations are conducted on the job by the supervisor.
(2) Evaluations are very thorough.
(3) The supervisor submits reports on a weekly basis, which ensures an accurate assessment of the graduates' performance.
(4) Data can be used to validate other forms of field evaluations.

b. Disadvantages of job performance evaluations are:

(1) It usually takes eight to ten weeks to conduct the evaluation.
(2) The supervisor reports progress weekly.
(3) The evaluator makes at least two TDYs to each base.

(4) The sample is limited.
(5) They normally focus on a single command.

10.4.2.5.1 Data collection. Data is collected via field reports submitted by the supervisor to an evaluation element for analysis. These reports "recap" the progress made during the previous week.

10.4.2.5.2 Preparing for the evaluation. As with any evaluation method, adequate plans should be made before starting. Planning tasks include:

a. Select recent graduates and their supervisors to participate in the job performance evaluation.
b. Allot enough time in the schedule to meet with the supervisor and the graduates to explain job performance evaluations and get the supervisor's commitment to support the evaluation.
c. Determine tasks to be evaluated based on the training standard. The criteria of performance are the training standard.
d. Establish evaluation milestones.

10.4.2.5.3 Conducting job performance evaluations. Once the participants have been selected and briefed on the process and its importance, it's time to begin the evaluation. The evaluation consists of the following activities:

a. The supervisor evaluates and records the graduates' performance on each task performed.
b. The supervisor reports, on a weekly basis:

(1) Tasks performed.
(2) Frequency of performance.
(3) Time required to perform the tasks.
(4) Equipment used.

10.4.2.5.4 Data analysis and reporting. When the evaluator receives the job performance reports from the supervisor, they are analyzed to determine how well the graduates are performing the tasks they were taught during the course. Evaluators should watch for reports that indicate the graduate can't perform a task learned in the course or that the graduate requires excessive help to perform the task. In these situations, data analysis should focus on determining why the graduate is not able to meet job performance requirements. Since the job performance evaluation is normally conducted in conjunction with the other forms of field evaluations, the results of data analysis are included in the TQR.

10.4.2.6 Other data sources. Other external data sources that can be used to evaluate the graduates' job performance are:

a. Organizational units periodically inspect instructional activities to determine their effectiveness. Other inspections conducted by these teams may also discover related problems. Use this source of data to determine if graduates are meeting their job performance requirements. Take appropriate action to correct deficiencies. One example of an Inspector General (IG) report is the Functional Management Inspection.
b. Standardization/evaluation team findings - teams periodically inspect instructional activities to determine their effectiveness. Analyze findings indicating a problem and take appropriate action to correct the deficiencies.
c. Training Quality Report - The supervisor of recent graduates reports strengths and weaknesses of the training the graduates. The training activity should respond to any deficiencies identified in the TQR. Note that one or two TQRs by themselves may or may not be justification to change or revise a course. Use problems identified in the report to validate findings of other forms of evaluation methods.

11. NOTES

11.1 Intended use. This handbook is intended to be used in conjunction with MIL-HDBK-29612-1, MIL-HDBK-29612-3, MIL-HDBK-29612-4, and MIL-HDBK-29612-5 to aid in the application of MIL-PRF-29612 for the acquisition and/or development of training related products.

11.2 Subject term (key word) listing.

Computer Aided Instruction (CAI)
Computer Managed Instruction (CMI)
Course
Courseware
Evaluation
Graphics
Instructional
Instructional delivery system
Interactive Courseware (ICW)
Interactive Multimedia Instruction (IMI)
Lesson
Learning Objective (LO)
Media
Test
Training

Training acquisition
Training data product
Training equipment
Training situation
Training support
Training system

APPENDIX A

ISD/SAT ACTIVITY PROCESS MODEL

A.1 SCOPE

A.1.1 Scope. This appendix provides an activity process model that visually represents the ISD/SAT process as described in the text of this handbook.

A.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

A.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

A.4 READING AN ACTIVITY PROCESS MODEL

A.4.1 Purpose of an activity process model. The purpose of an activity process model is to identify and document what a complex system or procedure does. Activity modeling makes it possible to represent not only the individual activity, but also the different circumstances under which each activity functions.

A.4.2 A-0 Diagram. The A-0 diagram is the top-most diagram in the model hierarchy. The A-0 diagram contains the A0 activity. As the first activity in the diagram, the A0 activity is the parent activity for all decomposition diagrams in the model. That is, the remaining levels of the diagram will describe, in greater detail, the activations of the A0 activity. The following definitions of process model terms are provide to aid in better understanding the model:

a. Node. A node in a function model is a point from which other parts of the model originate. Like branches of a tree: from a single node, several branches can originate which can in turn produce their own nodes, etc. The A0 activity serves as the top-level node from which several other activities (nodes) originate or unfold, each of which can potentially produce several other activities (nodes).
b. Decomposition Diagram. A decomposition diagram is a more detailed breakdown of an activity within a process. Each diagram following the A0 activity in a model is a decomposition diagram (excluding the top level diagram within the model).
c. Activation. Activation is the flow of a process.
d. Activity: An activity is an action taken. In an activity model, activities are graphically shone as boxes and described by active verbs.

e. Bundle. A bundle is a group of concepts that can be logically related. Each bundle has a parent concept which is elaborated by the set of child concepts in the bundle. Bundles are of two branch types. Bundles can either split (i.e., go from the single parent concept to a set of child concepts that enter several activities in the diagram) or join (i.e., move from the group of child concepts that exit various activities in the diagram to the single parent concept).
f. Tunneled Concept. A tunneled concept that either enters a diagram from outside the diagram's context or exits a diagram's context. Concepts that tunnel into a diagram are shown with parentheses at their external end, indicating that they are not used on the parent activity. Concepts that tunnel out of the diagram have parentheses on their internal end, indicating that they are not used in the next lower-level diagram. (To date there are no tunneled concepts in the ISD/SAT activity process model.)

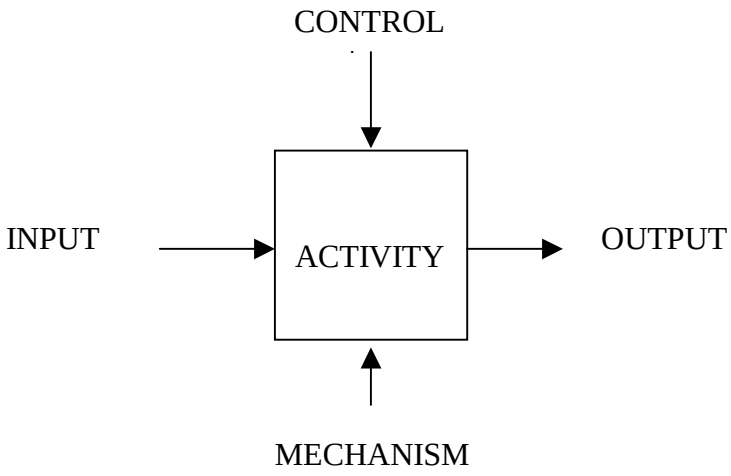

FIGURE 24. An activity with Input, Control, Output, and Mechanism (ICOMs) shown.

g. Concept: Concepts are objects or information used or produced by activities. They are represented in an activity model by arrowed lines. Concepts are attached to activities according to their different uses by the activity. Concepts consist of Inputs, Controls, Outputs, and Mechanisms (ICOMs). Figure 24 shows an activity with Input, Control, Output, and Mechanism (ICOMs) shown. Definitions of ICOMs are as follows:

(1) Input. The I in ICOM, inputs are resources used, consumed by or transformed by activities in the production of outputs. An input is represented by an arrow attached to the left side of an activity box.
(2) Control. The C in ICOM, controls (DoD instructions, for example) constrain or guide an activity's production of outputs. A control is represented by an arrow attached to the top of an activity box.
(3) Output. The O in ICOM, outputs are products produced by an activity. An output is represented by an arrow attached to the right side of an activity box.
(4) Mechanism. The M in ICOM, mechanisms are resources, such as employees or machines, that are used by activities in producing an output. A mechanism is represented by an arrow attached to the bottom of an activity box.

A.5 ISD/SAT ACTIVITY PROCESS MODEL

The ISD/SAT activity process model is provided as Figure 25 (37 pages).

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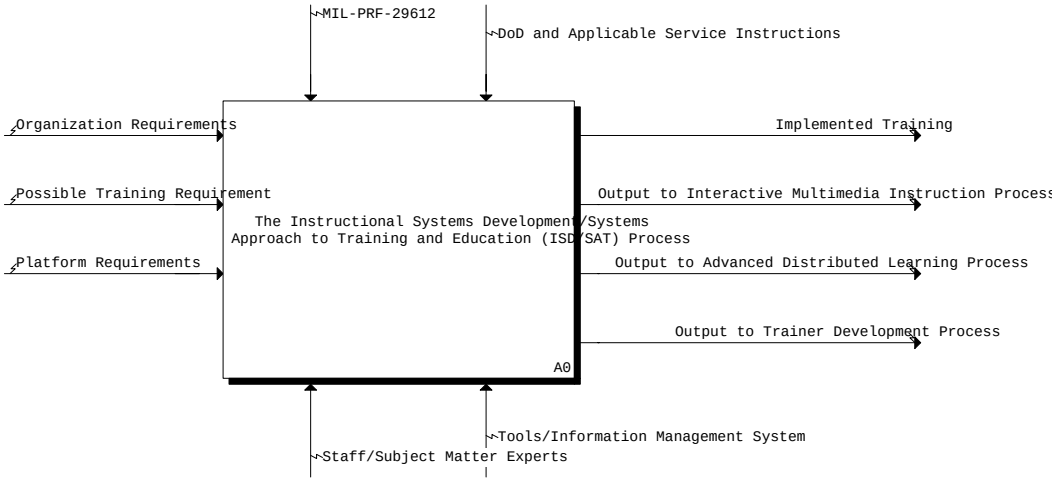

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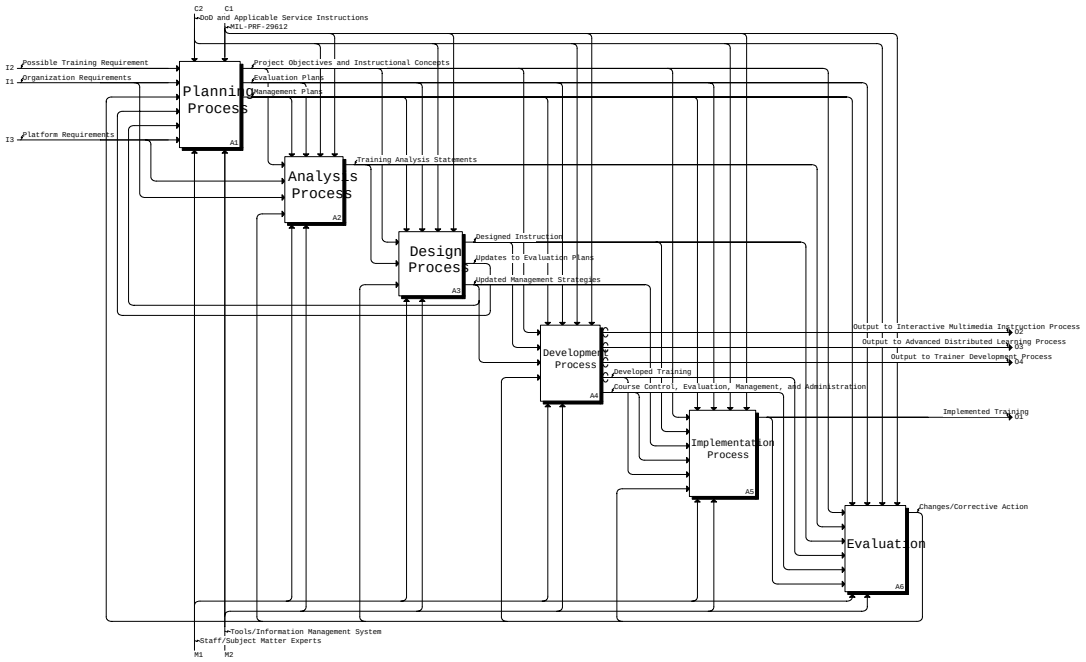

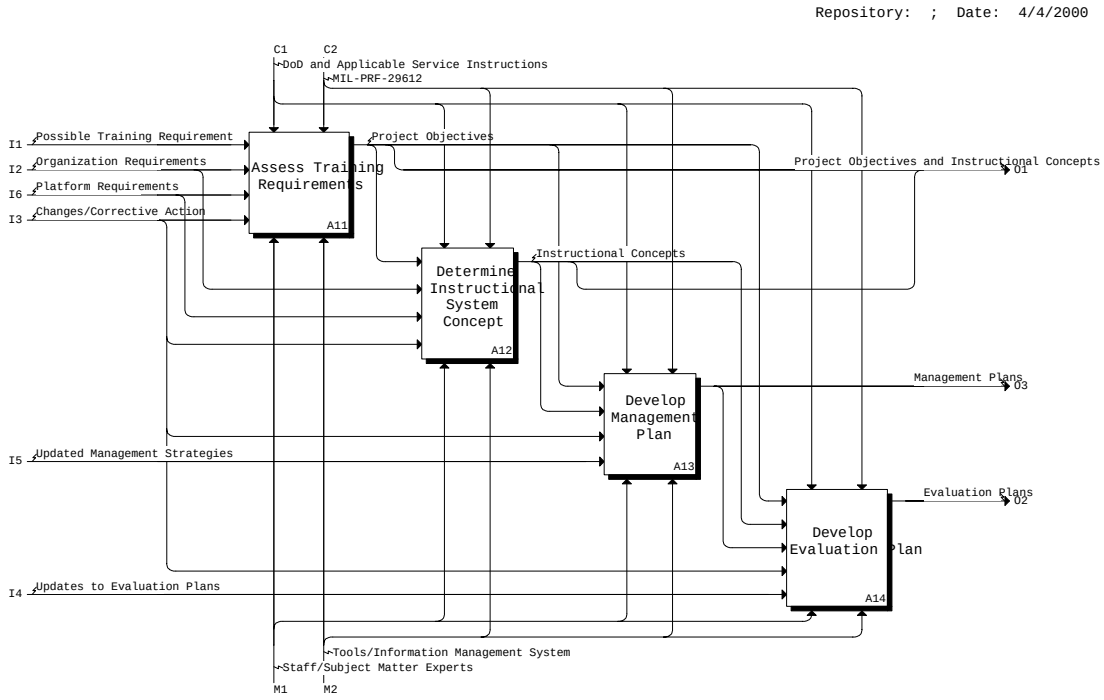

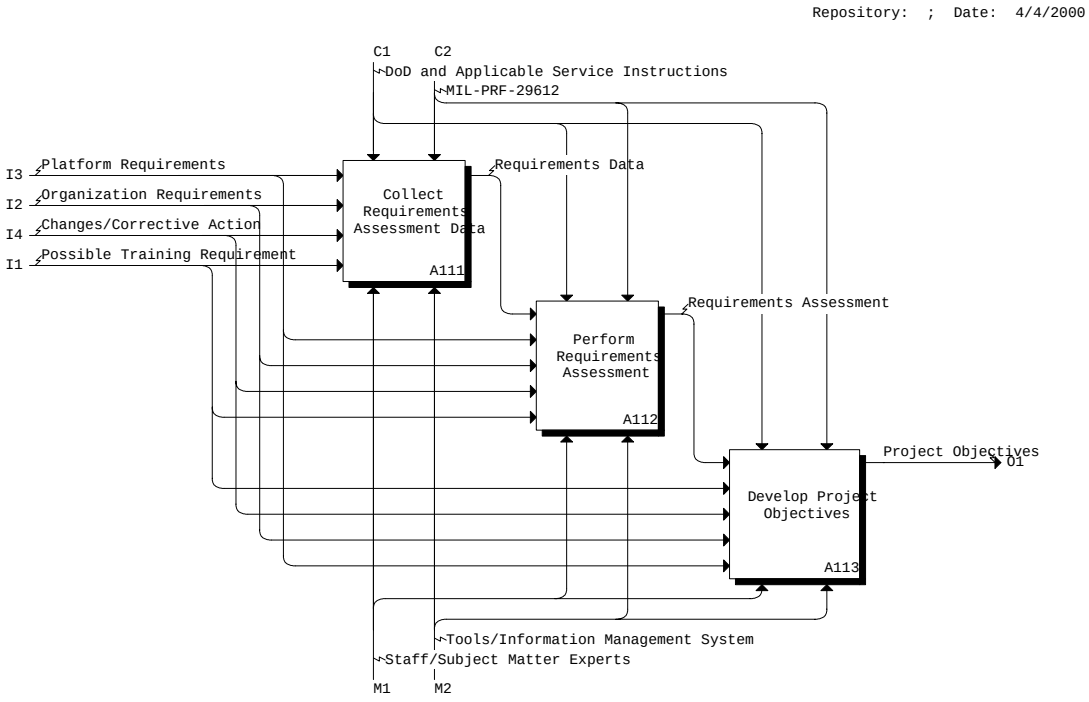

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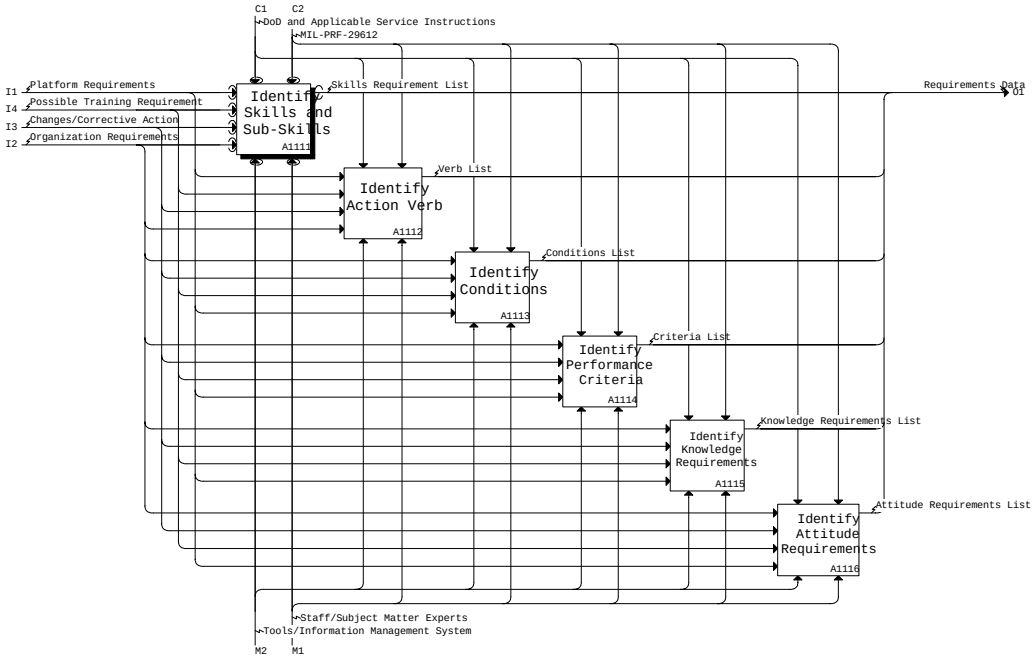

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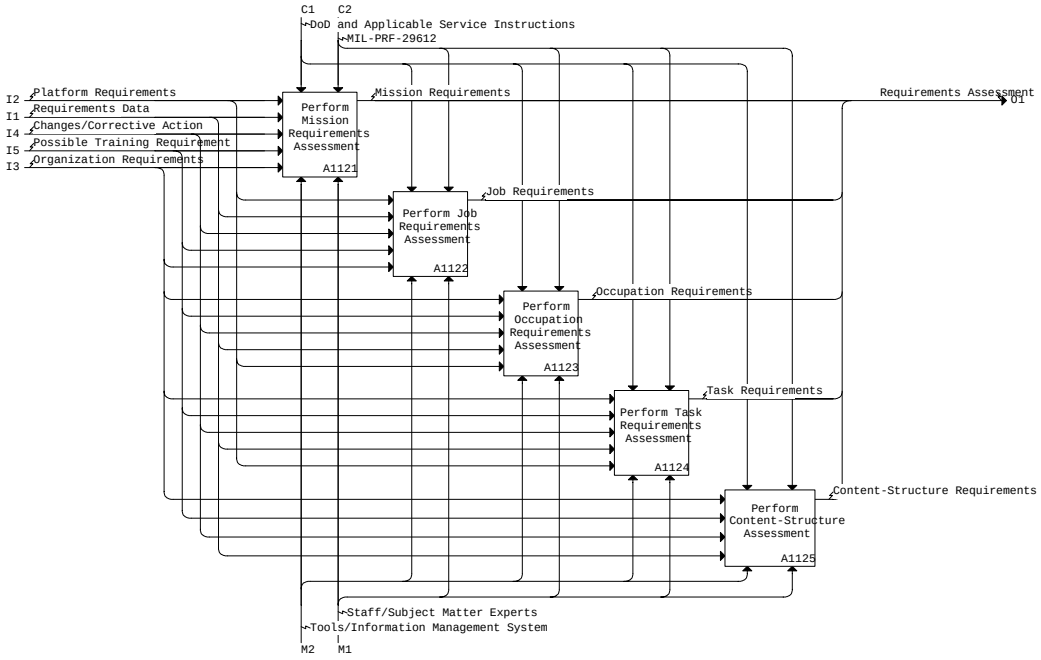

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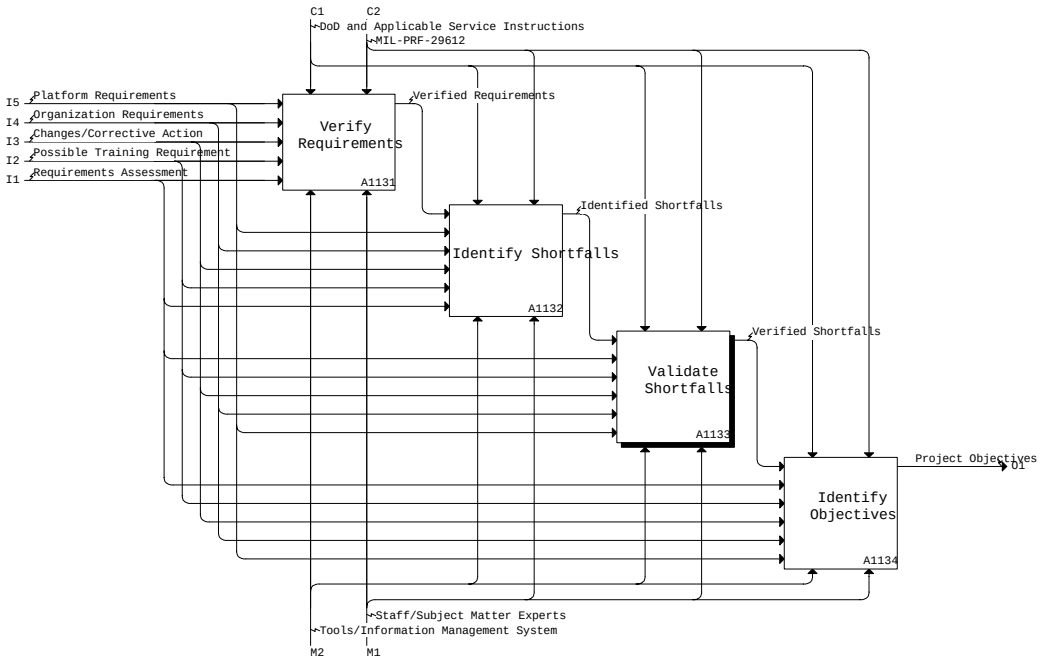

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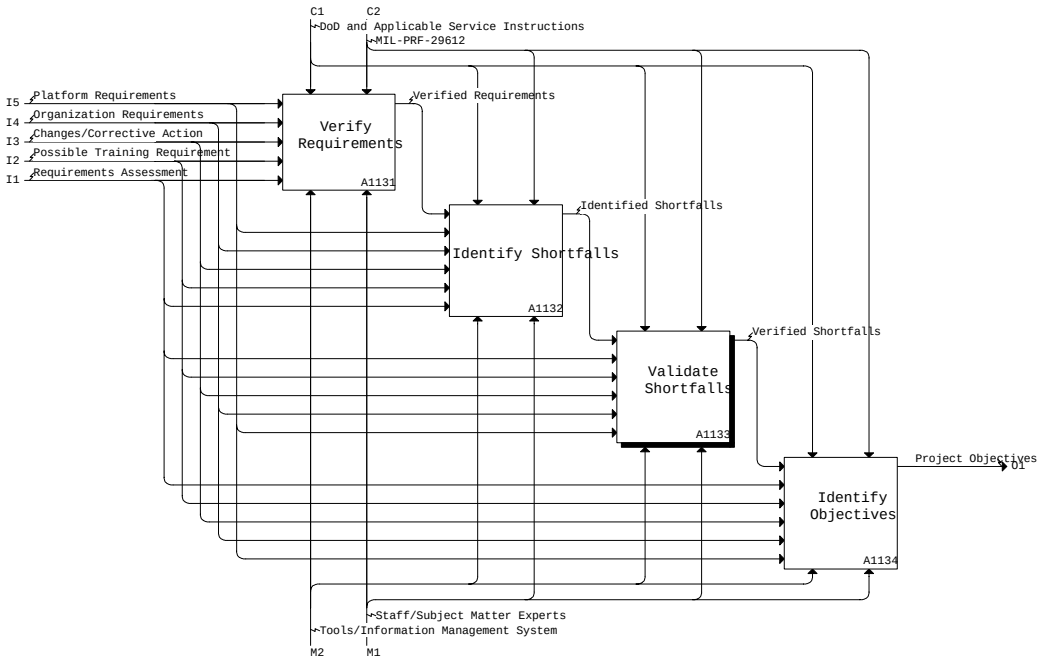

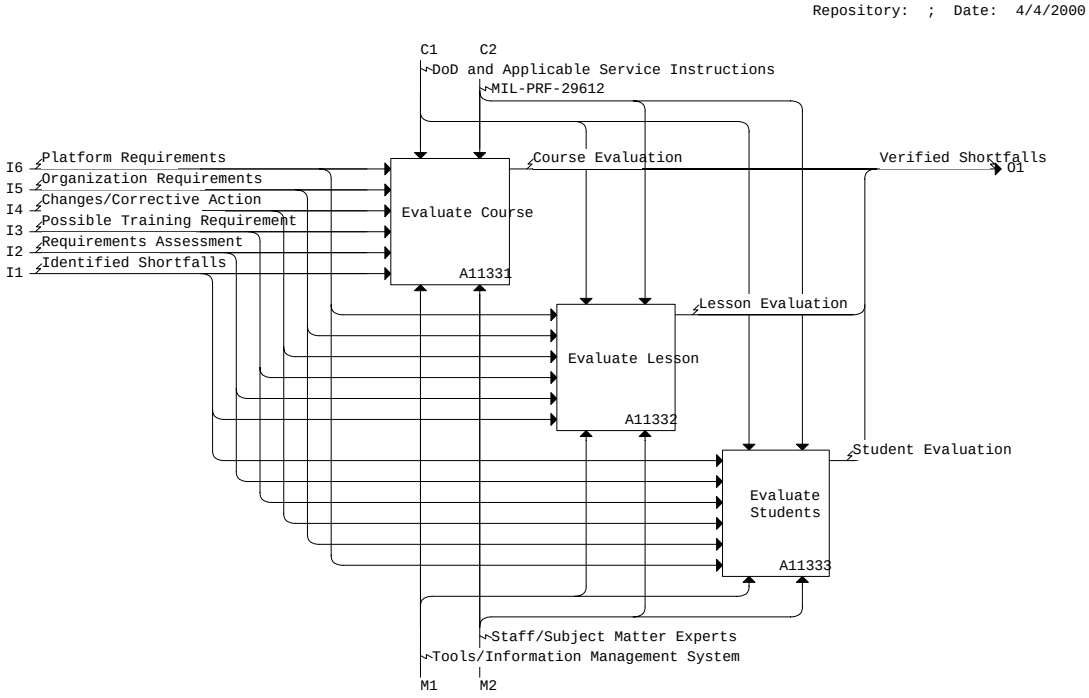

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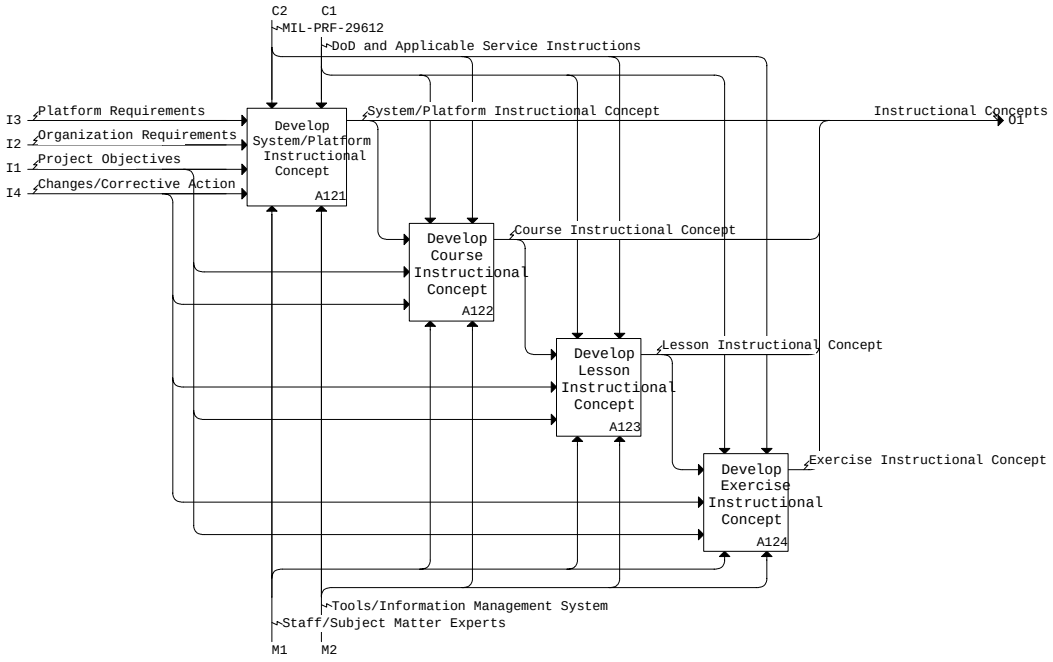

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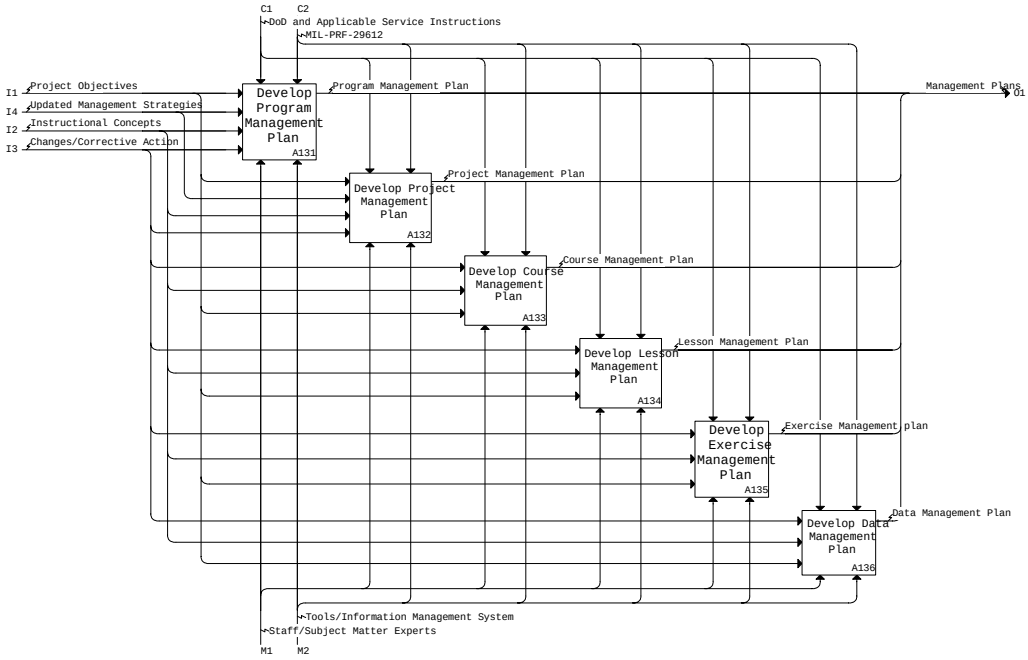

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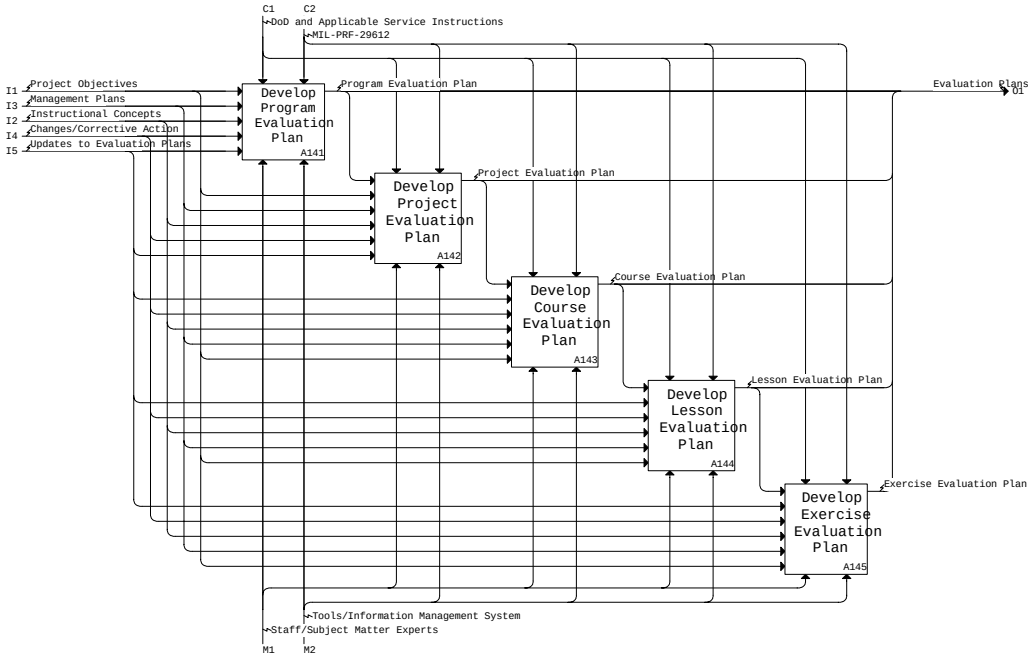

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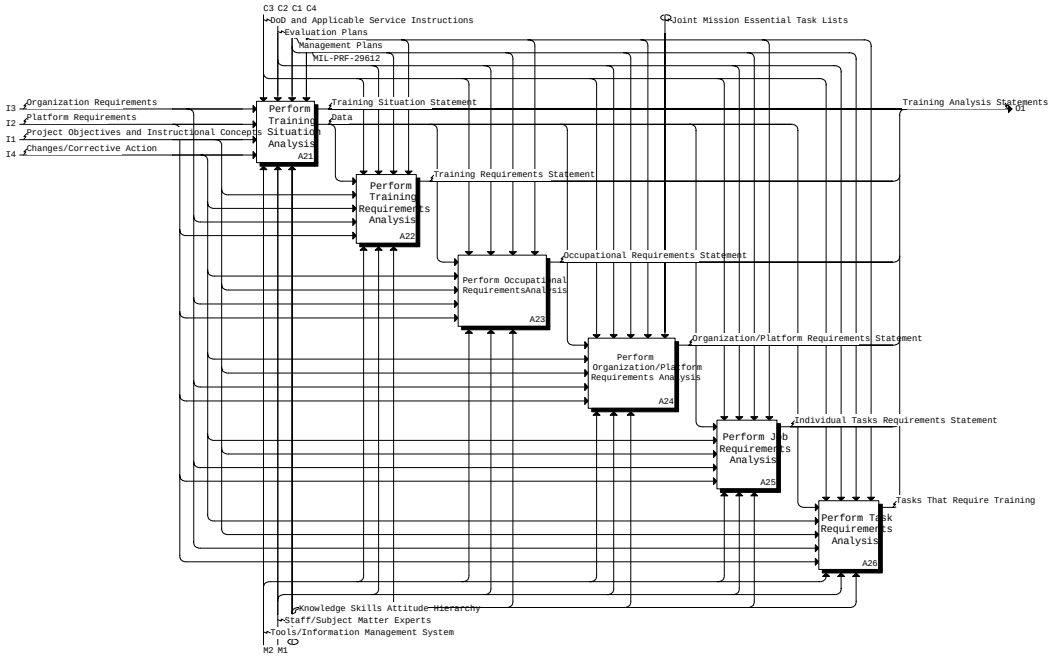

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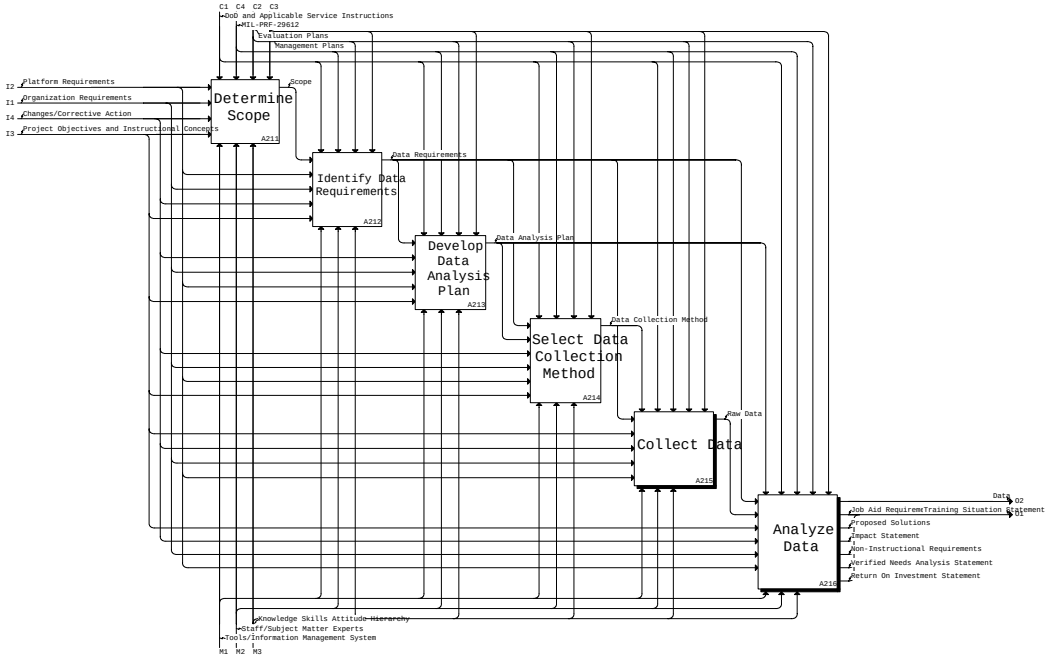

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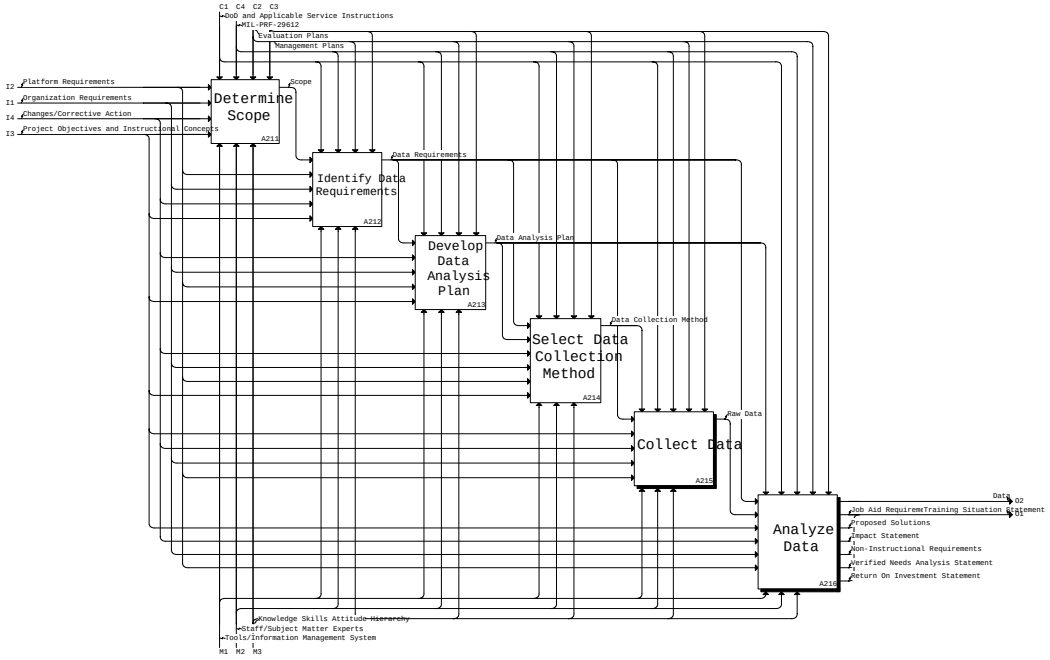

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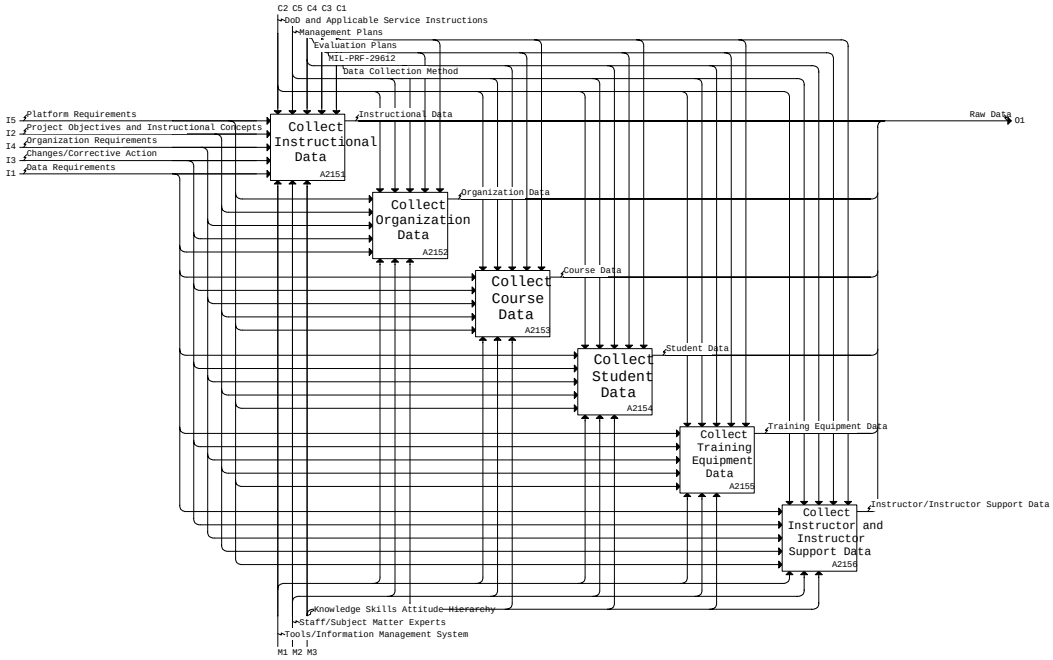

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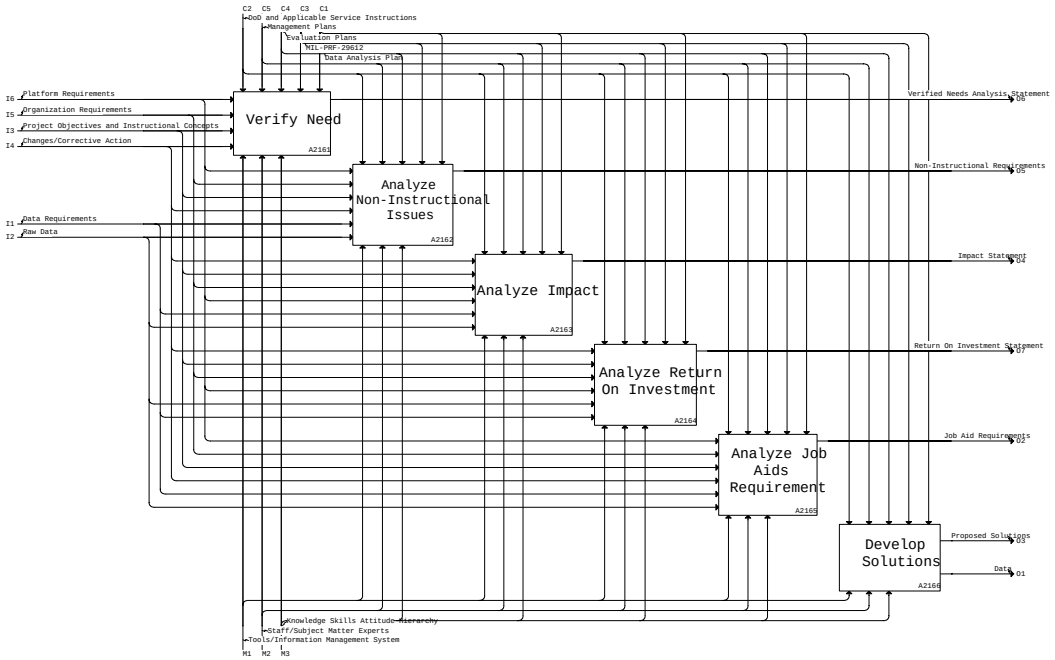

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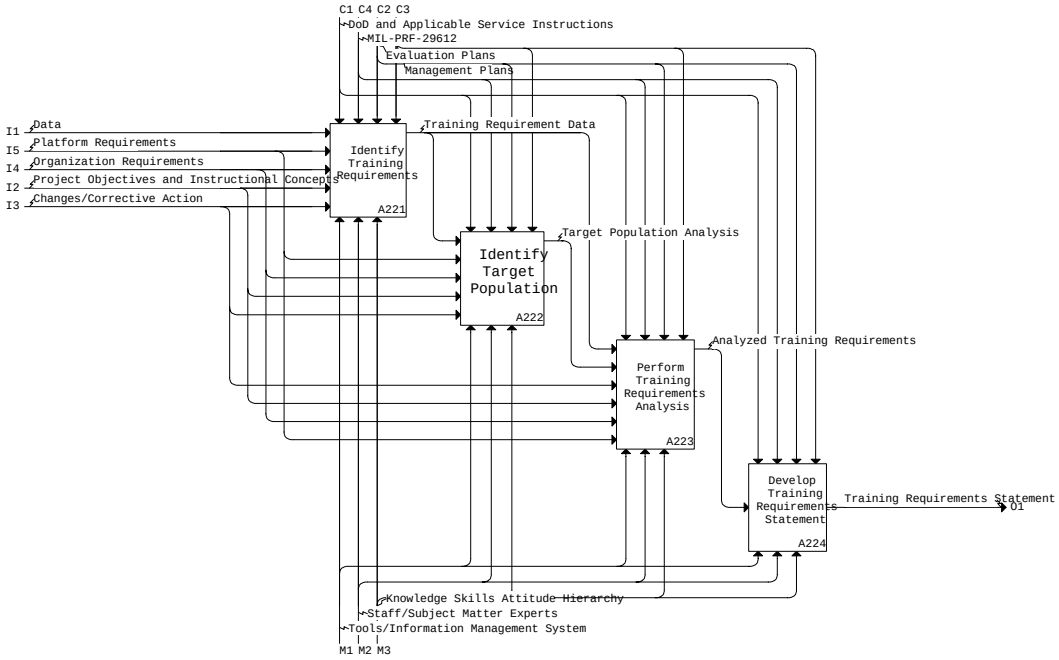

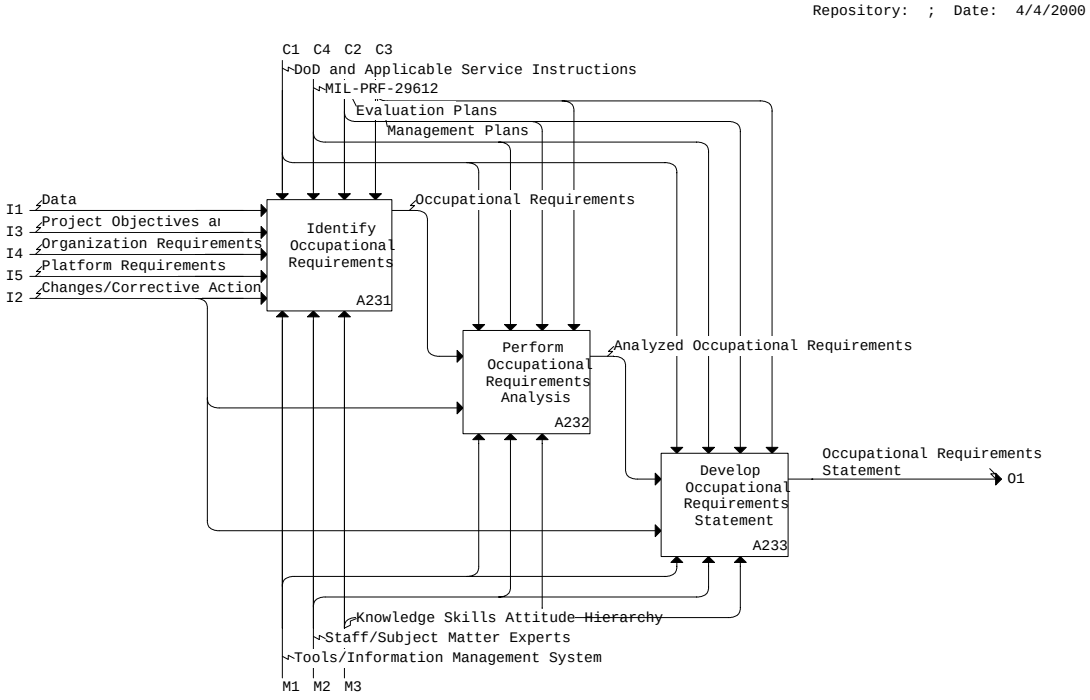

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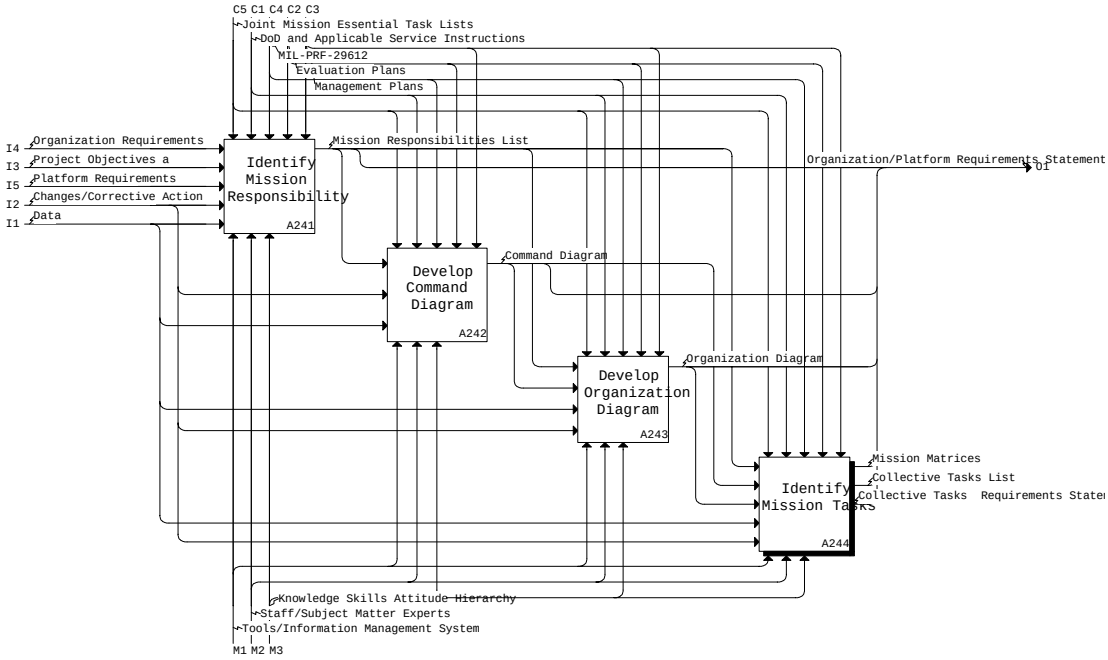

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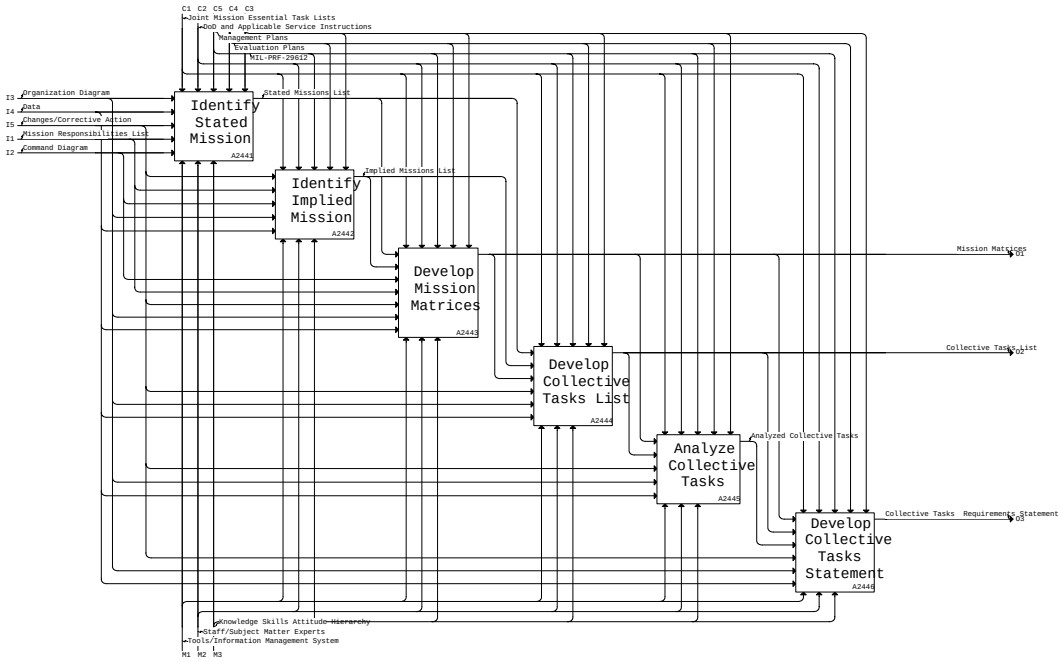

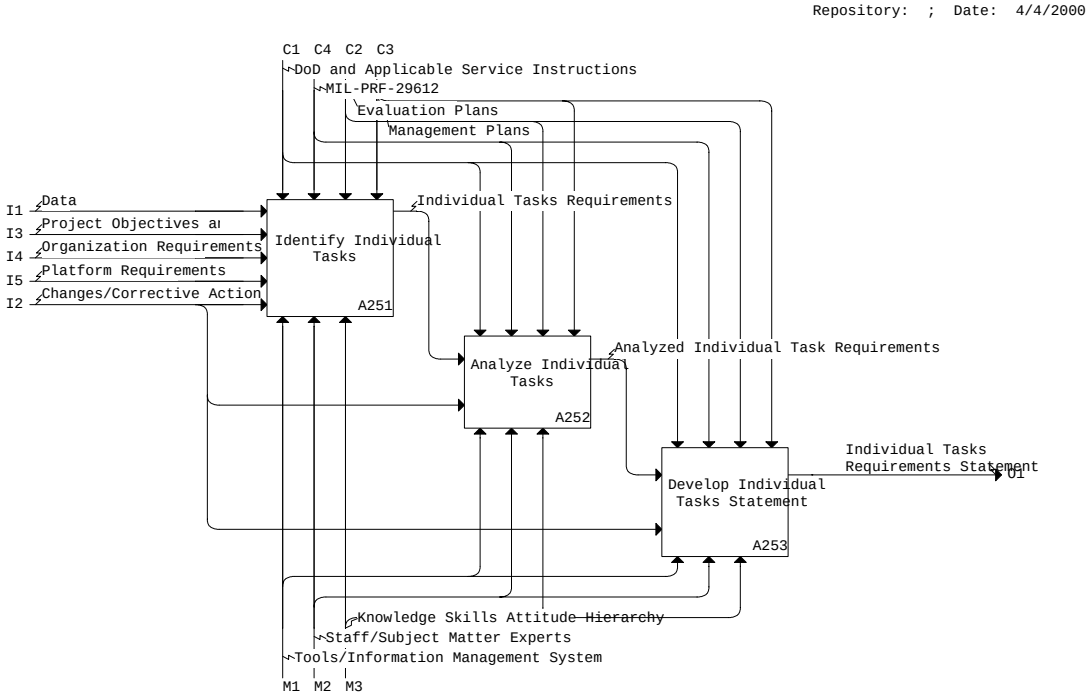

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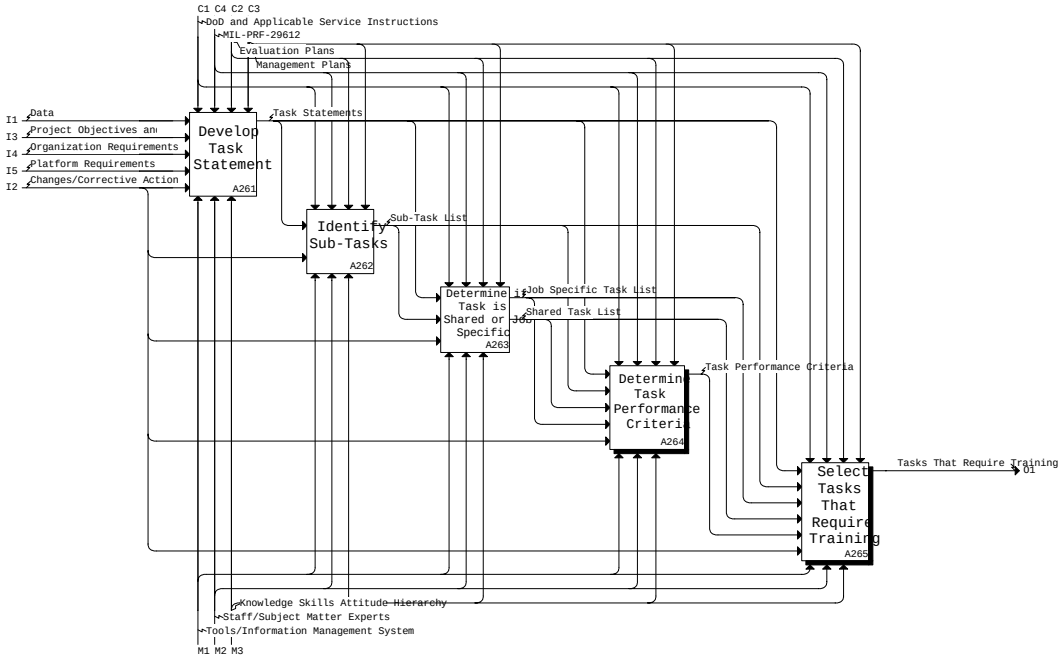

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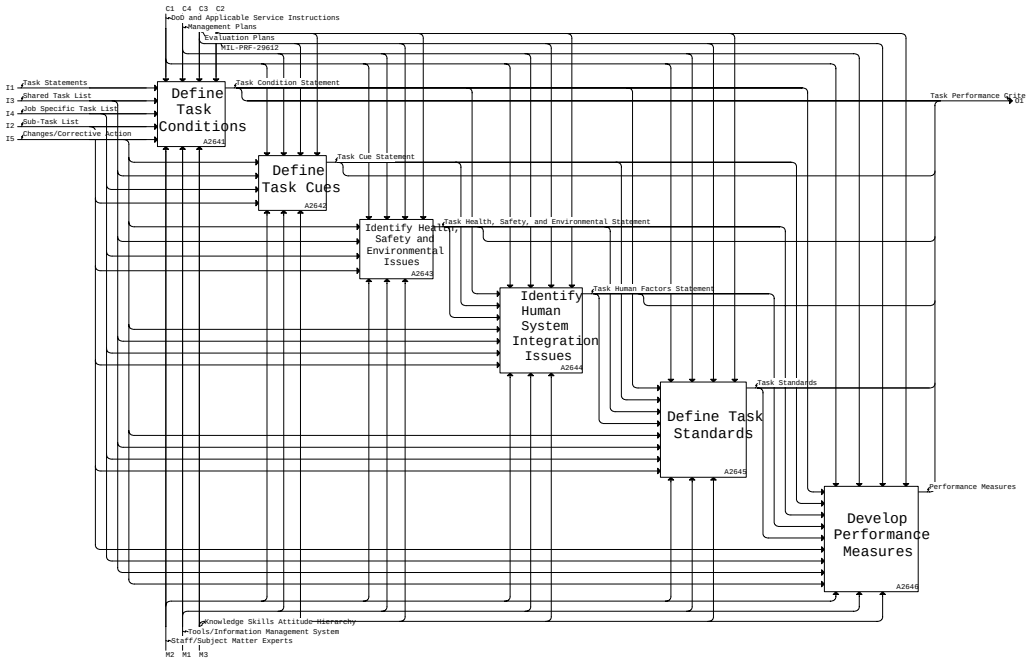

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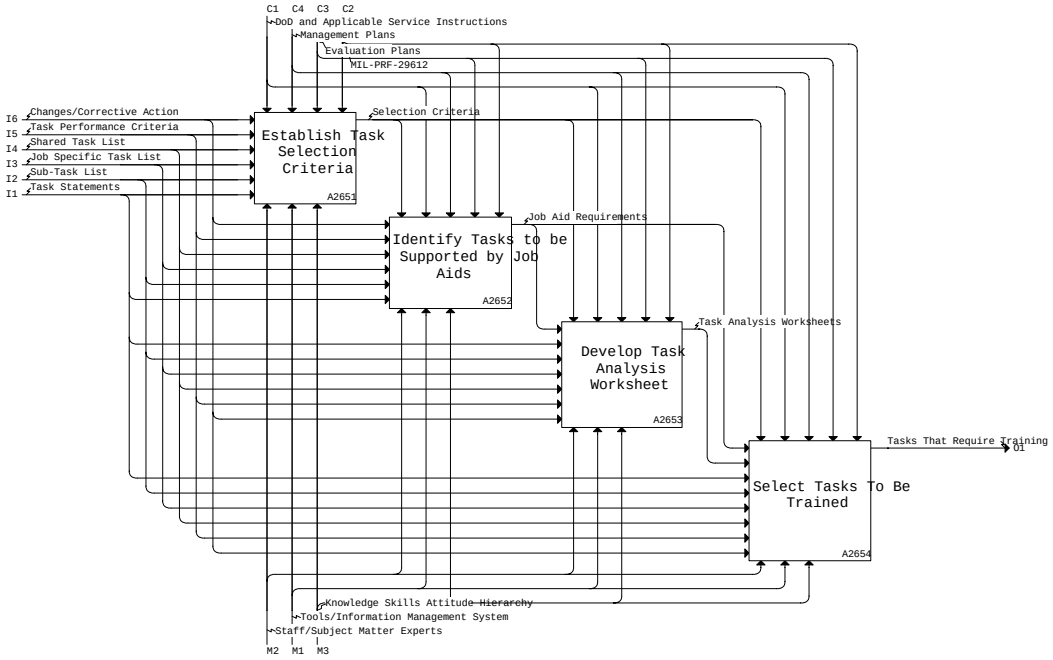

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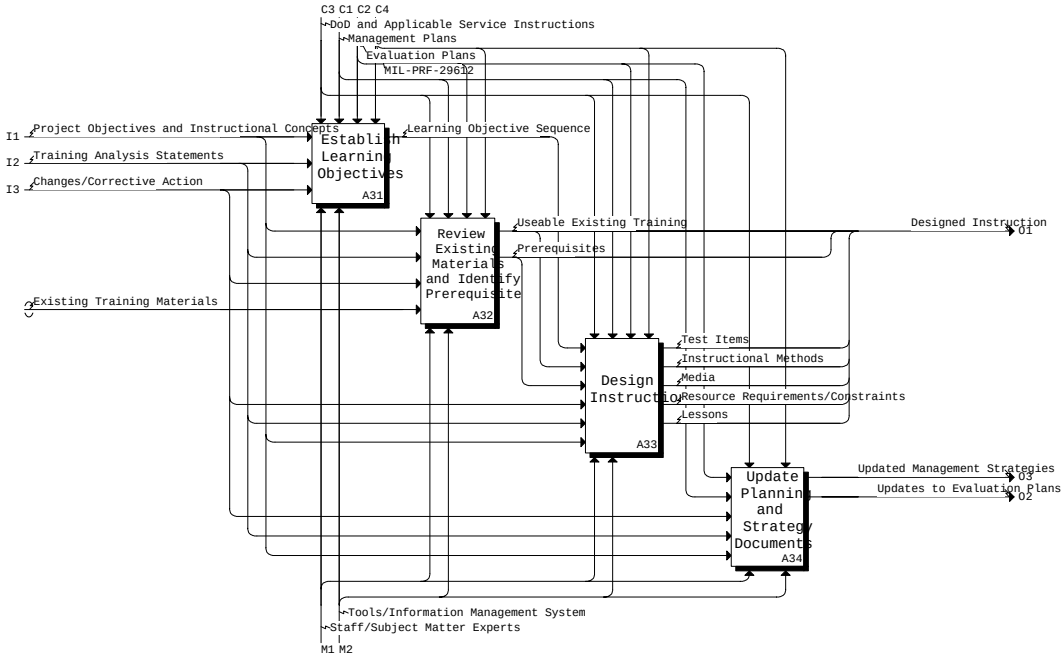

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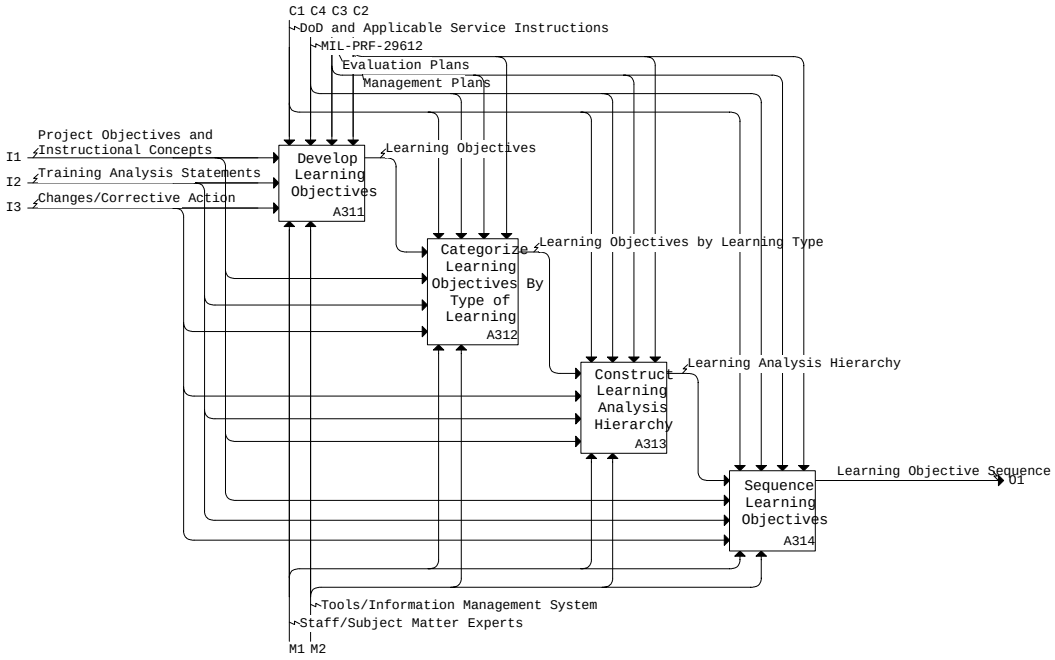

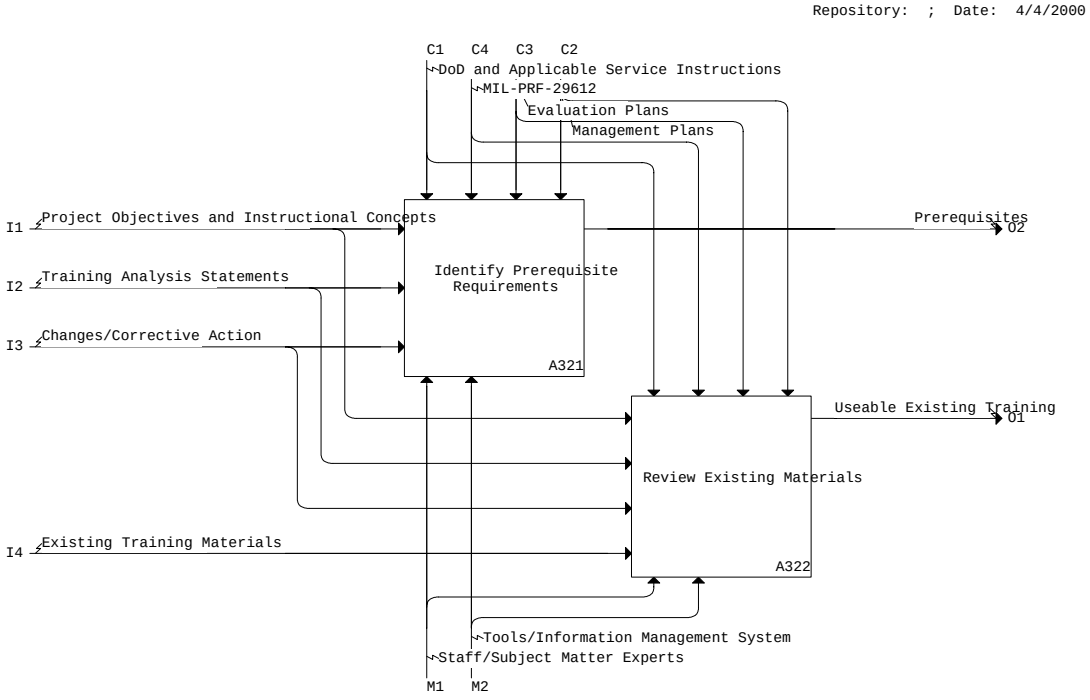

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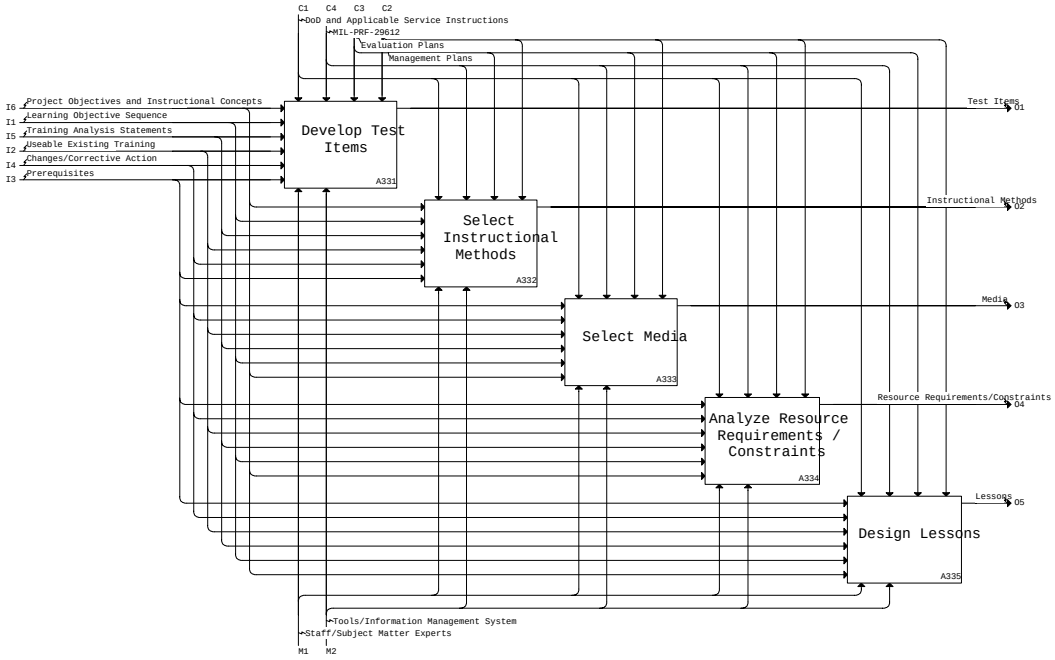

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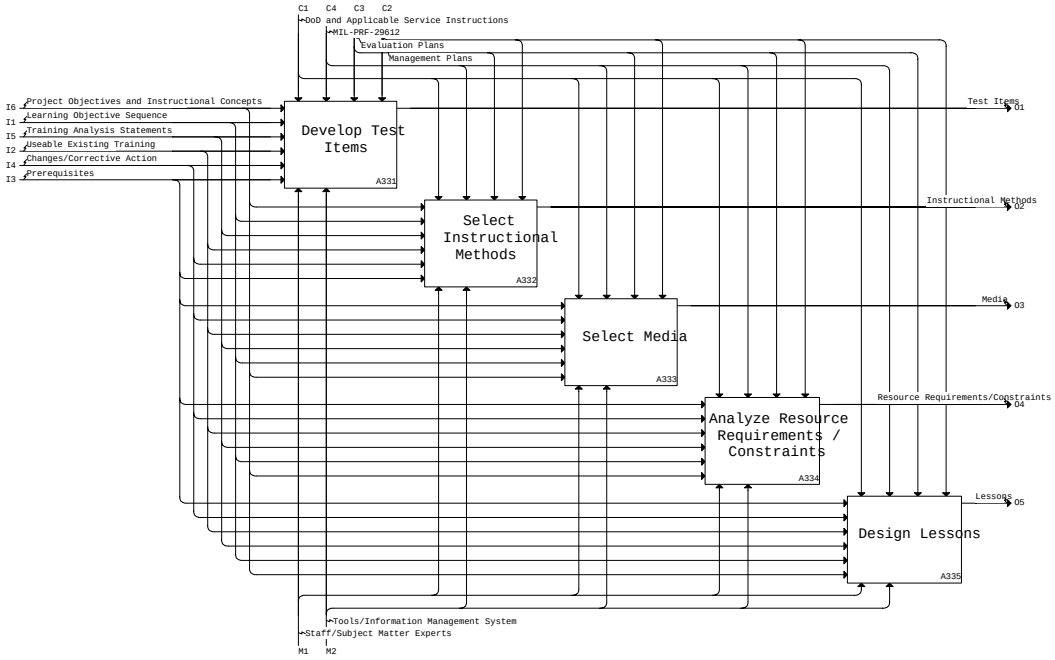

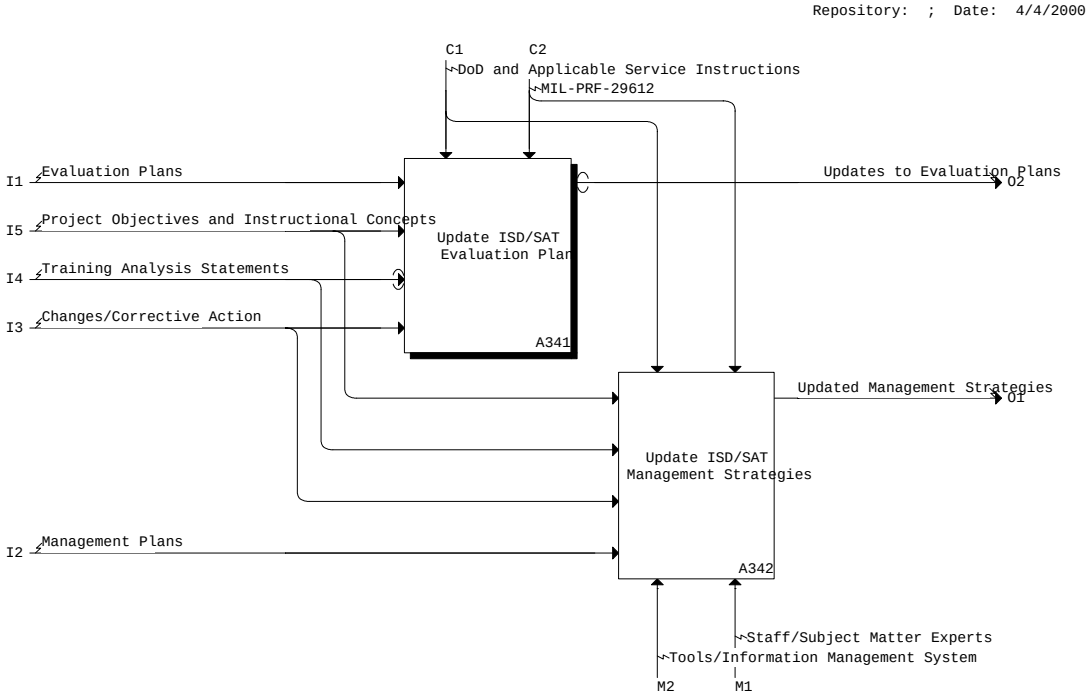

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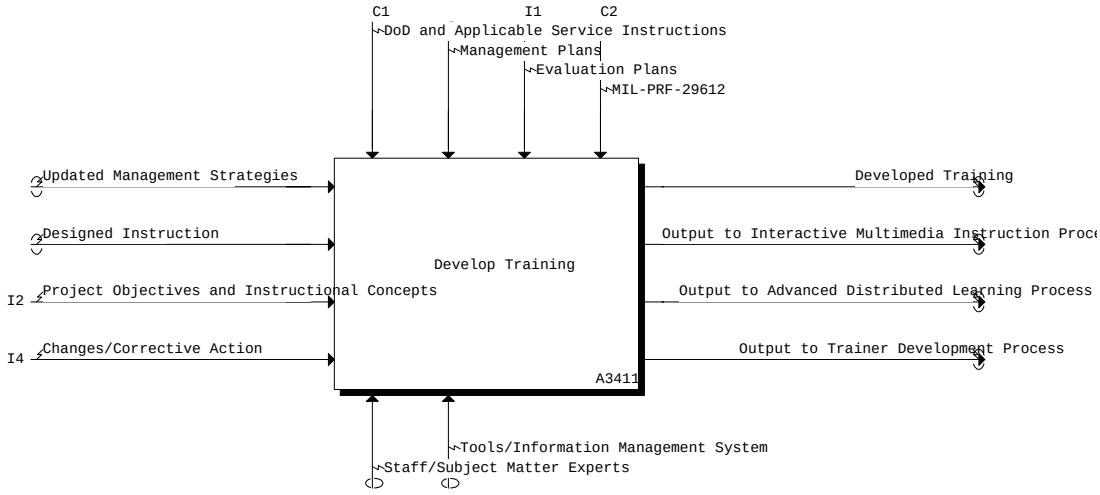

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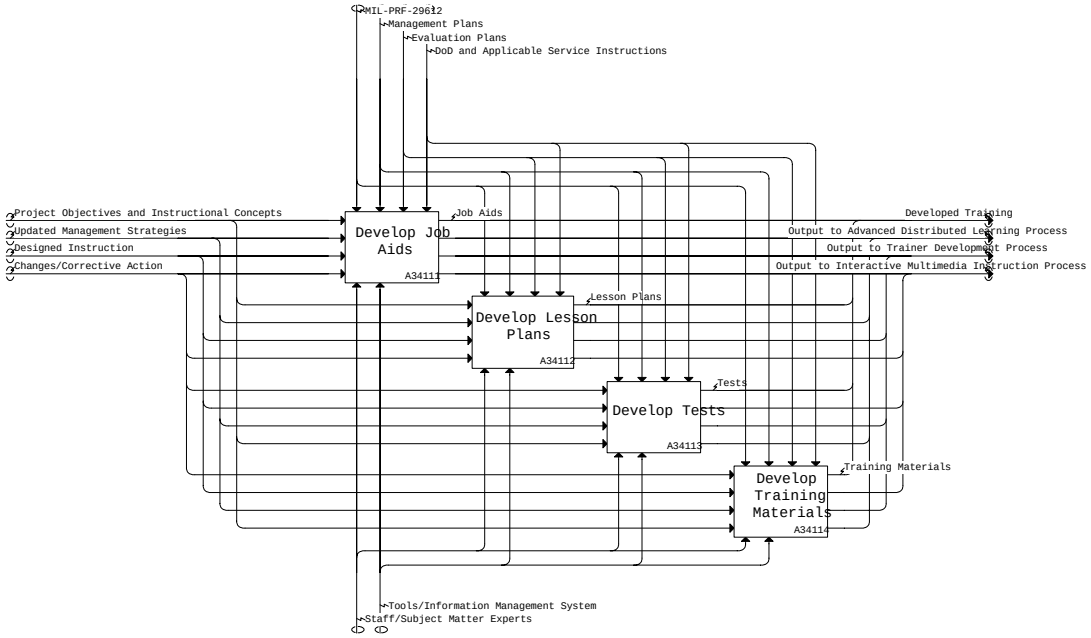

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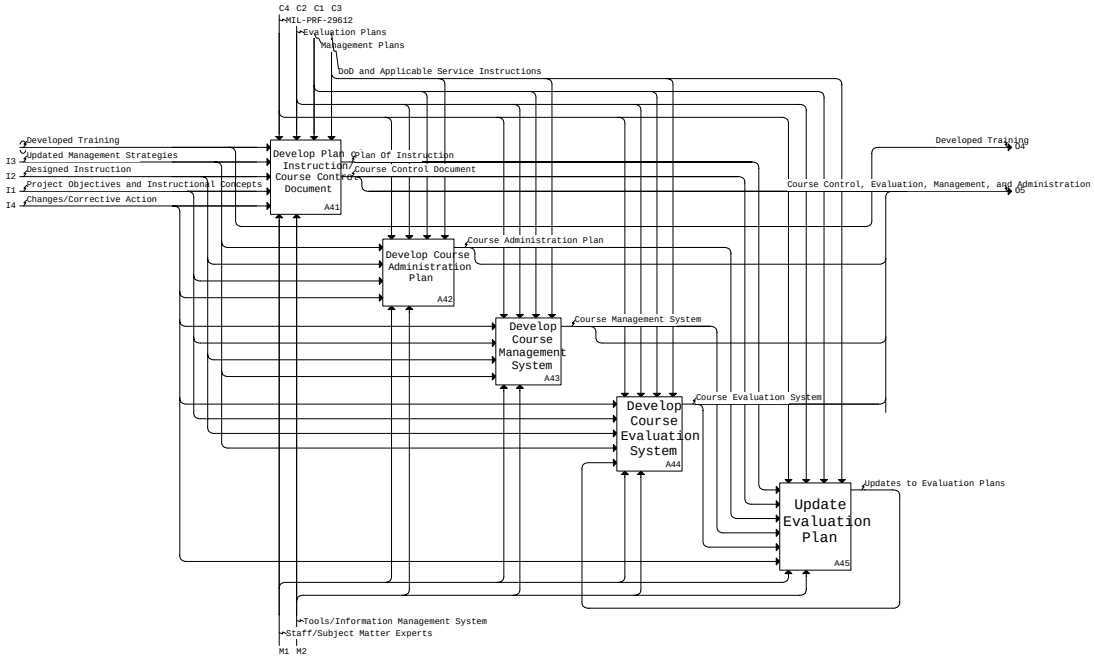

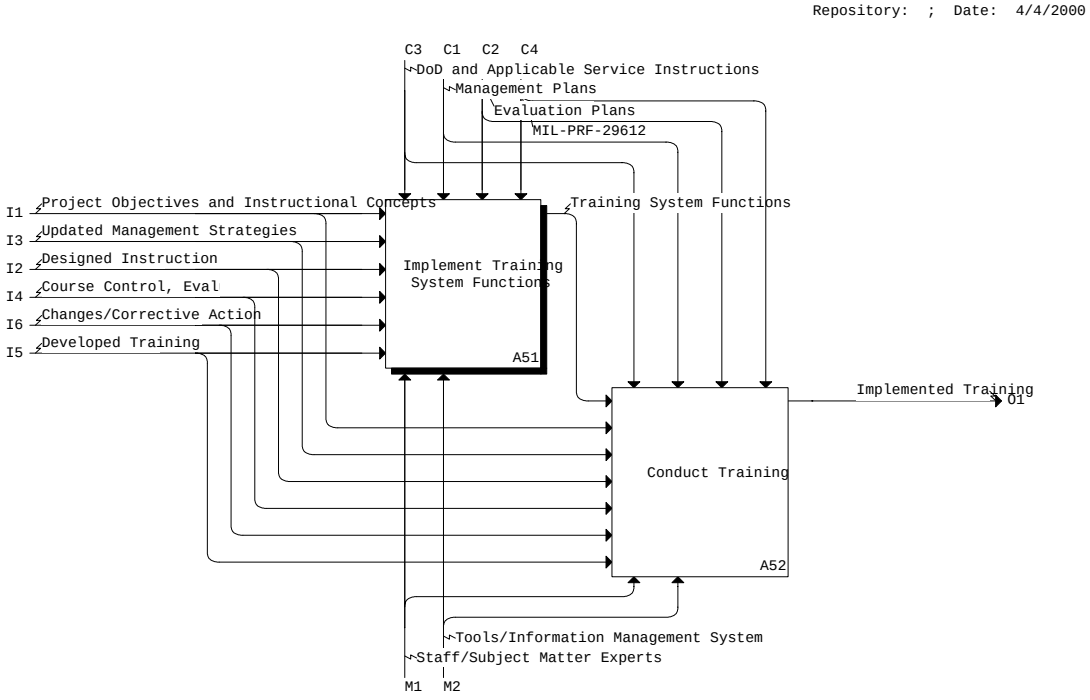

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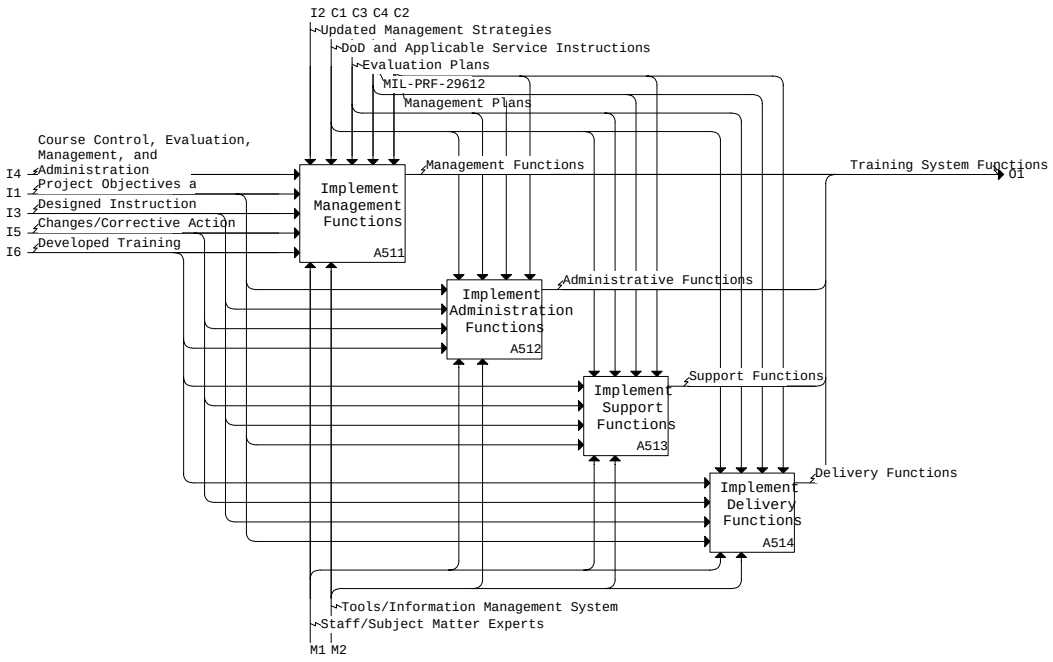

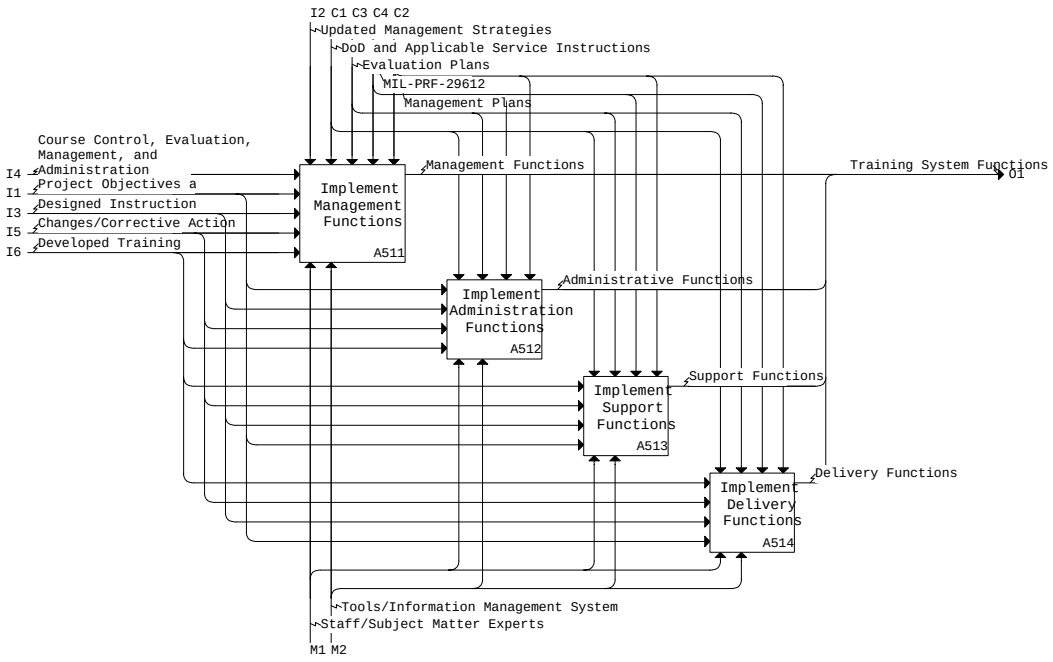

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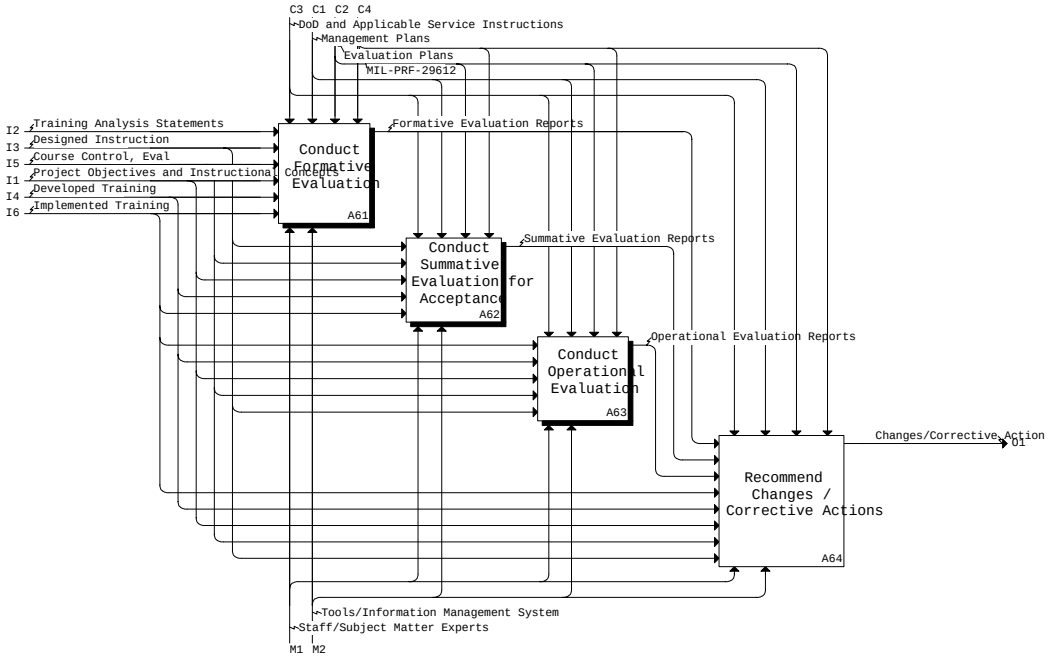

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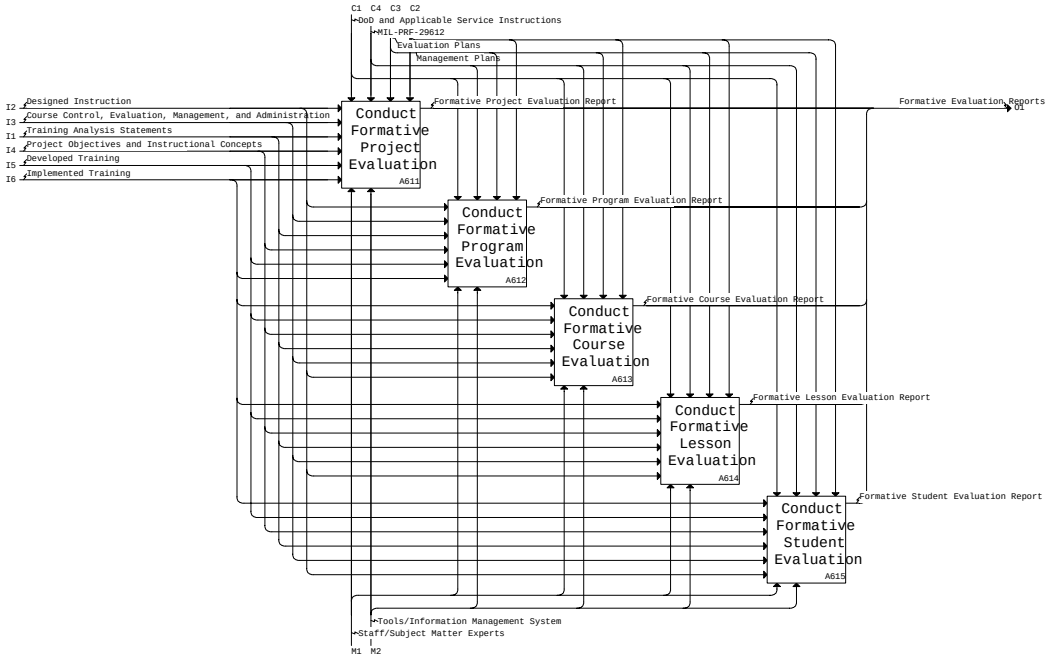

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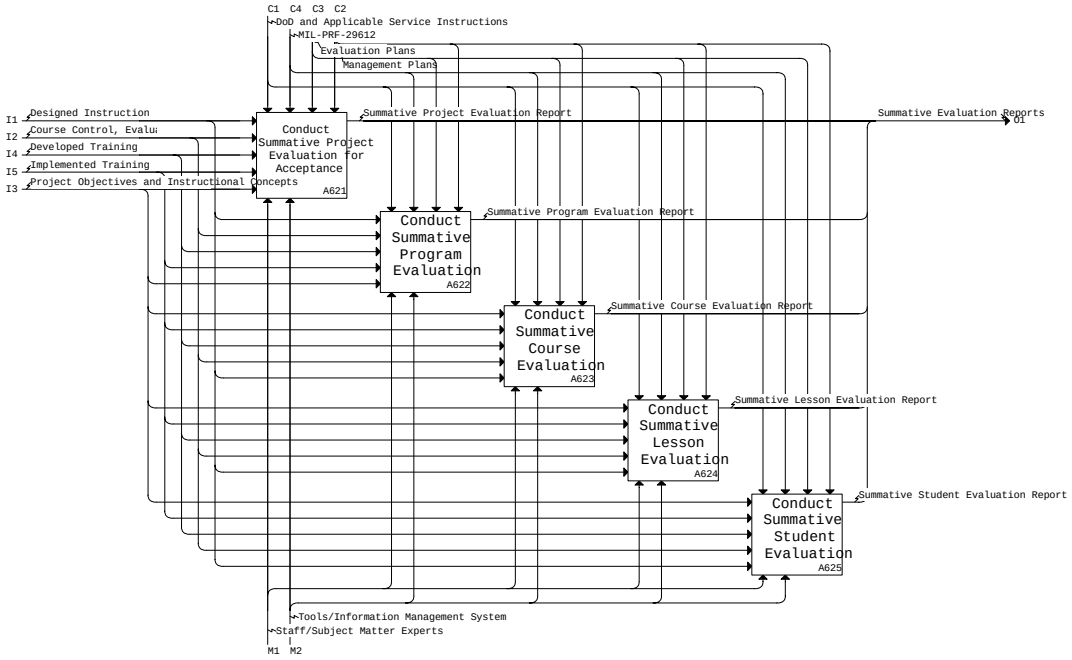

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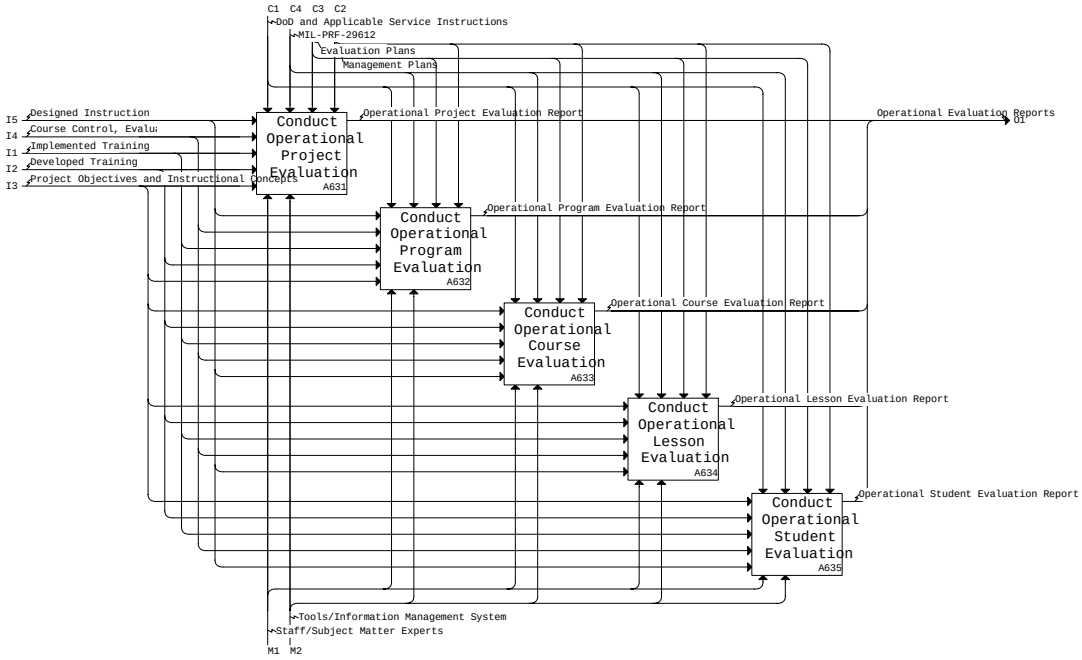

APPENDIX B

DATA COLLECTION

B.1 SCOPE

B.1.1 Scope. This appendix provides guidance to be used in data collection throughout the ISD/SAT process.

B.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

B.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

B.4 DATA COLLECTION

B.4.1 Data collection sources. Several sources of data can be used in the ISD/SAT process. Rarely will all information be available. Availability of data will likely vary for each development project. The sources of available data will be different when developing initial training for a new system or when developing training to accommodate a major modification to an existing system, than when updating a training program due to mission changes. For example, in the early life of a new system development, final technical documentation may not be available. Consequently, the best source of data may be engineering drawings, draft technical manuals, and interviews with engineers and SMEs. Other examples of sources are listed below:

a. Checklists.
b. Directives, manuals, handbooks.
c. Standard operating procedures.
d. User organizations.
e. System Program Office (SPO).
f. Manufacturer's manuals.
g. Contractor's data.
h. Joint task list.
i. Master training task lists.
j. Occupational survey report.
k. Major command input.
l. Frequency of performance data.
m. System training plan.

n. Universal/master task lists.

B.4.2 Data collection considerations. Instructional analysts must plan their data collection requirements and techniques before beginning data collection. The instructional analyst should decide what data will be necessary for the project. The analyst should then design a checklist for use during data collection to ensure that all necessary data is collected. The data collection sheets should be discussed between all personnel that are going to collect the data to ensure that the data is collected in the same manner. Table 44 is a sample checklist that can be used as a guide to determine what data needs to be collected. The contents and format of this sample are not the only acceptable design, each development project will probably require a modification to the sample to suit specific needs. The amount of data collected depends on the number of personnel that are interviewed. These personnel may have different ideas about the task, therefore, the instructional analyst should analyze all the collected data and make a final judgment on the rating of the selection criteria. The instructional analyst may have to design a form that can be used to consolidate the collected data.

TABLE 44. **Sample checklist for data collection**.

TASK DATA COLLECTION CHECKLIST	
System/Subsystem/Equipment Information	**Task Information** (Continued)
How it works	Support materials
How it is maintained	Support equipment
How it is used	Test equipment
	Tools required
Personnel Functional Responsibilities	Task cues
	Task conditions
Job Information	Task standards
	Task performance measures
Job title	Task decision points
Job purpose	Task performed from memory
Job steps/procedures	Common errors during task performance
Location of performance	Isolated task or complex task
Environmental conditions	Is this a skill (physical/mental) or knowledge task?
Task Information	**Training Task Selection Criteria**
Task titles	Safety hazard severity
Sub-task titles	Criticality of performance
Proper action verb assigned	Frequency of performance
Supervision required	Probability of inadequate performance
Assistance required	Difficulty of performance
Physical demands	Task delay tolerance
Safety precautions	Percent performing
Safety procedures	Percentage of time spent performing
Reference material	Immediacy of performance

B.4.3 Select data collection methods. A combination of the following methods and techniques can be used to identify the tasks and compile a total task inventory. More than one method should be used since each method has its inherent strengths and weaknesses.

a. The content method of data collection is a review of all available literature. The references compiled during mission and job familiarization provide an excellent starting point for task identification. The types of materials that are most informative depend on the nature of the mission or job. For example, if the jobholder is a maintenance technician, the maintenance charts and text in technical manuals identify many job tasks.

If the system to be supported is under development, then contractor data will be useful in identifying tasks.

b. The interview/survey method involves interviewing personnel currently serving in (or having recently served in) the job or position who have experience relevant to the subject area. Conduct this data collection method through face-to-face interviews and/or through a survey.

    (1) The instructional analyst should review the literature and become familiar with the functional relationships to properly structure the questions to be asked. The questions should be tried out during interviews. During the interview, the interviewer should modify the questions so that there is clear communication about the subject. Once the questions are stated in a way that resultant answers form redundant patterns, the survey may be conducted by questionnaire. At that point the surveyor is collecting data on trends, and the number of respondents is more important than face-to-face interviews.
    (2) The use of questionnaires permits the instructional analyst to determine whether the responses from personal interviews reflect the opinions of a large number of people. Questionnaires have the advantage of yielding large amounts of information at a relatively low cost and do not require trained interviewers.

c. In the group interview, job incumbents are assembled to give information relative to their job. The instructional analyst asks questions about job performance and may ask the group to list particular data on tasks that cannot easily be demonstrated or observed. Because the group interview involves recall rather than recognition, it may provide inaccurate or incomplete data.
d. The observation/interview method involves sending the instructional analyst to observe and interview job incumbents and their supervisors on the job. Observing the job incumbents at work allows flexibility in gathering the required data by providing the instructional analyst opportunities to continually evaluate the information obtained. Direct observation of personnel as they perform their job, combined with interviews, provides the most useful source of task information. The instructional analyst should have a thorough understanding of the literature and functional relationships of the job to correctly interpret and describe the behaviors observed.
e. In the jury-of-experts method, experienced and knowledgeable personnel from various activities are brought together to record and analyze the data on jobs for which many critical behaviors are not directly observable. This method can effectively supplement on-site observation/job analysis and written surveys. The experts are selected for their experience and knowledge of the job.
f. Data collected may include video, head tracking data, electronic or recording of data bus impulses. These techniques may be used to collect job performance data in instances

where the job performance or data requirement is too complex for other data collection methods.

B.4.4 Ask the right question. When collecting data, focus on getting the necessary information for task analysis. This can be done by asking the right questions during data collection. Examples are given in Table 45.

TABLE 45. **Asking the right question**.

TO IDENTIFY:	**ASK THE QUESTION:**
• Procedures, activities, steps.	What does the person do first? Next?
• Tools, materials.	What is used to perform the task?
• Weapon system.	What is the task performed on?
• Cues.	How do they know when to perform what?
• Work environment or conditions.	Under what condition is the task performed?
• Performance standards.	What is the standard of acceptable performance?

APPENDIX C

JOB AIDS

C.1 SCOPE

C.1.1 Scope. This appendix provides detailed information on the use of job aids.

C.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

C.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

C.4 DETAILED JOB AID GUIDANCE.

C.4.1 What is a job aid. A job aid is a tool people use to minimize the need for recall when performing tasks. A job aid may support the performance of the total task or a portion of it. The following information applies to job aids:

a. A job aid is a repository for:

(1) Information.
(2) Processes.

b. A job aid may also:

(1) Be external to the group or individual.
(2) Support work and activity.
(3) Indicate when and how to perform.
(4) Direct, guides, and enhances performance.
(5) Reduce the reliance on memory required to perform the task.
(6) Use diverse formats.

C.4.2 Determining whether to use a job aid. Confirm a job aid is the appropriate solution for performance requirement or deficiency. Job aids may only assist in solving problems due to lack of knowledge. They are an alternative to requiring individuals to learn to "recall". A job aid may be used for review prior to performance. Table 46 provides information for considering using a job aid. Prior to developing a job aid identify:

a. The best way of performing or approaching a task.
b. Common errors made by performers.
c. Type and level of assistance needed.

TABLE 46. **Job aid considerations**.

IF	THEN, CONSIDER
1. Rapidity of performance is vital.	Learning to recall.
2. Environmental considerations or safety reasons preclude job aid.	Learning to recall.
3. Use of job aid can cause embarrassment or loss of credibility.	Learning to recall.
4. Smooth and fluid performance is required.	Learning to recall.
5. Conditions are varied and unpredictable.	Learning to recall.
6. High rate of accuracy is vital.	A job aid.
7. Performance changes frequently.	A job aid.
8. Performance is complex.	A job aid.
9. Performance has numerous or hard to remember steps.	A job aid.
10. Performance is infrequent.	A job aid.
11. Performance requires a large body of information.	A job aid.
12. Scarcity of training resources is a problem.	A job aid.

C.4.3 Weigh advantages and disadvantages. Performance from recall is impressive, fast, and very costly to learn. Guided performance (using a job aid) is accurate, easily changed, and relatively inexpensive to learn. When considering job aids weigh the following factors:

a. Advantages of job aids are that they can:

(1) Serve as memory joggers.
(2) Support complex, difficult processes or difficult decisions.
(3) Help manage vast quantities of information; reduces reliance on memory.
(4) Support rapidly changing information, procedures, and policies.
(5) Reduce or replace training.
(6) Save time and money.
(7) Help people perform their jobs better.
(8) Help people feel better about new and challenging jobs.
(9) Ensure more consistent performance.
(10) Address challenges of less-skilled individuals and rapid turnover.

b. Disadvantages of job aids are that they can:

(1) Raise questions about resources.
(2) Increase paper in the job environment.
(3) Foster oversimplification.
(4) Be difficult to field and maintain.
(5) Be difficult to find appropriate funding.
(6) Be inappropriate for some task performances.

C.4.4 Review types and characteristics of job aids. The three types of job aids and their characteristics are provided in Table 47.

TABLE 47. **Types of job aids**.

TYPE AND PURPOSE	CHARACTERISTICS
INFORMATIONAL - Provides access to information in arrays, checklists, and decision tables.	• Forms a ready reference for facts and concepts. • Answers the questions of WHO-WHAT-WHICH-WHEN-WHERE. • Is organized by a user frame of reference, function, or subject-matter structure so as to emphasize relationships and connections. • Can be actively employed when needed.
PROCEDURAL - Prompts procedures in steps, worksheets, and flowcharts.	• Answers question HOW TO. • Answers question WHEN. • Emphasizes actions by highlighting verbs. • Presents actions as steps in sequence. • May provide feedback, showing action paired with results (so that individuals can judge their interim as well as their final performance).
COACHING (before or after performance) - Guides perspectives, decisions, and self evaluation in arrays, checklists, and decision tables.	• Answers question WHY. • Answers question HOW as in "How should I approach that?". • Allows for uncertainty and encourages discussion about confidence levels. • Makes suggestions rather than providing directions. • Emphasizes thoughts, feelings, and meanings. • Models organizational perspectives on work and life. • Articulates quality standards. • Encourages interaction with job aid.

C.4.5 Job aid formats and definitions. Formats and definitions for job aids are provided in Table 48. They do not include all possible formats supporting a given type.

TABLE 48. **Job aid formats**.

FORMAT	DEFINITION
Steps	A sequenced presentation of information, directions, and activities in sequence.
Worksheets	A sequence of steps requiring user to participate with written responses such as calculations.
Arrays	A body of information with meaningful organization and structure.
Decision Tables	A table presenting "IF-THEN" or "WHEN-THEN" situations requiring user to identify solutions.
Flow Charts	A sequence of "YES-NO" questions with each decision based on previous one.
Checklists	A list of critical questions or functions user must consider or verify before, during, or after performing task.
Reminders	A memory aid such as a light, audio signal, or safety note.
Electronic Performance Support Systems	A computer software package that supplies immediate access to integrated information, learning opportunities and expert consultation - with scope and sequence user controlled.

C.4.6 Identify the user. Note any factors, such as reading ability, that will impact on using specific kinds of job aids. Review task performance to determine:

a. Typical performance.
b. Information task performers need.
c. Performance prerequisites.
d. Other acceptable ways of doing task.
e. Circumstances that might change the way task is performed (day/night, visibility).
f. Safety considerations.
g. Environmental considerations.
h. Associated level of risk.
i. Cautions or reminders.
j. Particularly difficult steps, actions, or events.
k. Often forgotten steps.
l. Acceptability of job aid to performer.
m. Task closure.

C.4.7 Specify the work environment(s). Specify the work environment the job aid will be

used in (i.e., field, shop, trailer, hangar, bay, desk).

C.4.8 Developing job aids. Using the above factors as a guideline, determine if a job aid should be developed for the particular tasks under consideration. If the decision is not to develop job aids, proceed to the process of selecting tasks for the training task list. If the decision is made to produce a job aid, the procedures below should be followed:

a. Develop and validate the job aid.
b. Determine if use of the job aid by the jobholder changes the conditions under which the task is performed. Revise the task statement to reflect the changes caused by the job aid as needed.
c. If the task can easily be performed by using the job aid, it should not be selected for training. If the task is selected for training, because even with the job aid some training is required, the task should be on the training task list.

C.4.8.1 Prepare a draft job aid. When preparing a draft job aid organize the information previously collected. List task information requirements, note if sequence is important, and review all situations where the job aid is to be used.

C.4.8.2 General guidelines. Use the following general guidelines when developing job aids:

a. Ensure title tells users what to expect when using job aid.
b. Construct clear and distinct statements.
c. Tell when to use job aid.
d. Utilize the performer’s vocabulary.
e. Provide examples.
f. Emphasize action.
g. Present information in small pieces.
h. Integrate graphics and drawings.

C.4.8.3 Specific guidelines. Follow specific guidelines for selected format as detailed in Table 49.

TABLE 49. **Job aid format guidelines**.

FORMAT	GUIDELINES
Step	• Make the sequence clear. • Number or letter the steps. • Make certain each step represents only one activity.
Work Sheet	• Make the sequence clear. • Number or letter the step or calculation. • Put questions or prompts before the space for response. • When possible make completely separate or detachable from supporting documentation.
Array	• Base the layout on the nature of data or the structure of potential demands. • Organize logically. • Indicate specific version or date of array (especially for data that changes frequently).
Decision Table	• Work backwards from where the user will finish then identify the factors that will lead the user there. • List possible solutions or responses to IF or WHEN statements (that is the conditions or chain of factors). • Determine IF or WHEN statements that lead to solutions or responses. • List IF or WHEN statements according to importance, time, space, or other relevant category(s). • Ensure that each decision sequence leads to only one solution or response (when more than one answer, use checklist format).
Flow Chart	• List all solutions or responses. • Develop a series of questions that lead to the possible solutions or responses. • Using a diagram layout the questions and activities leading to a solution or response. • Use diamonds for decisions and boxes for activities. • Use horizontal and vertical lines to connect diamonds and boxes. • Avoid crossed lines.
Checklist	• List conditions, events, objects, or questions in the order typically encountered by the user. • Provide sufficient information to guide the user to appropriate solutions or responses. • Provide information in a logical sequence. • List or describe the possible responses.
Reminder	• Keep short. • Place where it will be seen or heard.

C.4.8.4 Checklist for job aids. Table 50 is provided to assist in determining if the job aids that are produced are acceptable.

TABLE 50. **Checklist for acceptance of job aids**.

QUESTION	YES	NO
Is job aid designed from user point of view?		
Are any potential implementation problems identified? If so, do you have a strategy to resolve?		
Can you link job aid with improved performance?		
Can you link improved performance with incentives or other reward?		
Are supervisors involved in acceptance of job aid?		
Have SME and supervisors signed off on design?		
Have SME and supervisors signed off on initial draft job aid?		
Are key elements grouped and chunked?		
Are all critical elements present?		
Are non-critical elements deleted?		
Are pictures used whenever feasible?		
Can the job aid be improved by color coding, highlighting, white space, bulleting, or outlining?		
Have all typographical errors been fixed?		
Is the job aid user friendly?		
Is the job aid attractive and aesthetically pleasing?		
Can the job aid be made easier to use?		
Does the design support the requirement?		

C.4.9 Validate the job aid. Choose a test group of three to five individuals representative of end users (i.e., incumbents or previous incumbents). Have the group individually perform the task with the draft job aid. Train group members how to use the job aid only when job incumbents will be formally trained. Observe each trial user performing the task. Note if furnished job aid was used, how it was used, and if any confusion was associated with the use. Administer a job aid questionnaire. An example of a job aid questionnaire is provided in Table 51.

TABLE 51. **Job aid questionnaire.**

#	QUESTION	YES	NO
1	Was a job aid appropriate for this task?		
	If not, why not?		
2	Did the job aid help you?		
	If not, why not?		
3	Was the job aid easy to use?		
	If not why not?		
4	Was the job aid sufficiently comprehensive?		
	If not, what should be added?		
5	Was the job aid too detailed?		
	Specify.		
6	Was text easy to understand?		
	Specify where unclear.		
7	Were the visuals helpful?		
	Specify where not.		
8	Would you recommend that your colleagues use the job aid?		
	If not, why not?		
9	Would you use the job aid again?		
10	If trained before tryout, was training adequate?		
11	If trained before tryout, was training necessary?		
12	How would you improve the job aid?		

C.4.10 Revise the job aid. Base the changes to the job aid on your observations, data collected from the job aid questionnaire, and comments provided by users.

C.4.11 Try out revised job aid. When substantive revisions were made, begin the process of job aid acceptance by completing the checklist in Table 51. Revalidate the job aid in the same manner that validation was previously conducted.

C.4.12 Determine how the job aid will be produced. Identify who will produce the job aid. Estimate or get estimate of how long it will take from the production agency. Estimate the resources required and where they are coming from.

C.4.13 Determine how the job aid will be distributed. Identify who will distribute the job aid. Estimate or get an estimate of how long it will take for distribution from the distribution agency. Estimate the resources required for distribution. Specify events needed to distribute the job aid.

C.4.14 Develop a plan. Use a Gantt chart or network diagram and plan of action and milestone chart to show events and timelines. Use Table 52 when planning for fielding a job aid.

TABLE 52. **Fielding job aid checklist**.

QUESTION	YES	NO
Are users trained in use of the job aid?		
Have users been shown the advantages and disadvantages of using a job aid?		
Has acceptance of change been addressed?		
Will workers receive feedback on job performance?		
Have environmental problems been eliminated?		
Is the job aid compatible with work environment?		
Has use of job aid been linked to job performance for supervisor acceptance?		
Are there incentives for improved user job performance?		
Have SMEs and supervisors signed off on final product?		
Is there a method for evaluating use of job aid after fielding?		

C.4.15 Get the plan approved. Submit the plan to the chain of command for approval and implementation.

C.4.16 Develop a management plan. Address all administrative issues and responsibilities. Use Table 53 to assist in completing a management plan for job aids.

TABLE 53. **Checklist for job aid management plan**.

DOES THE PLAN:	**YES**	**NO**
• determine how the job aid will be kept current?		
• ensure revisions are automatic and mandatory?		
• indicate how we keep track of what's out there?		
• indicate who has the job aid?		
• indicate where is the job aid?		
• specify how and when revisions to the job aid will be made?		
• specify who will initiate revision?		
• specify who will revise?		
• specify who will reproduce the job aid?		
• specify who will field the job aid?		
• specify how outdated versions will be replaced or ensure outdated versions are withdrawn?		
• review job aid orientation, training, and coaching systems?		
• ensure orientation, training, and coaching systems are current?		
• ensure date of latest revision is incorporated?		
• ensure the job aid remains relevant?		
• ensure the job aid remains accessible?		
• ensure an adequate audit trail?		
• incorporates quality control throughout management process?		

C.4.17 Get the plan approved. Submit the plan to the chain of command for approval and implementation.

C.4.18 Identify and maintain an audit trail. Use local instructions to identify requirements for the audit trail. Maintain the audit trail by including documents that indicate and support decisions that were made and actions that were taken. Include all data needed to reconstruct the process that resulted in the final job aid. Retain all relevant correspondence.

APPENDIX D

TASK LEARNING CATEGORIES

D.1 SCOPE

D.1.1 Scope. This appendix provides guidance on the categorization of tasks according to their related learning types.

D.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

D.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

D.4 DETAILED TASK LEARNING CATEGORY GUIDANCE.

D.4.1 Categorize tasks. Identify the category of learning associated with the task to aid the instructional analyst in determining the best methods and media to support instruction of the LOs. The identification of these categories will assist in writing the LOs and selecting appropriate events and activities to support learning. Task learning categories are defined in the following paragraphs.

D.4.1.1 Intellectual skills. Intellectual skills are the foundation for all higher learning. They consist of discrimination, concepts, and rule-using. Cognitive strategies are often called a higher-order type of intellectual skill. Intellectual skills are hierarchical in nature. In order to learn a higher-order skill, the student should possess the prerequisites. To learn a rule or principle, the student should understand the component concepts and the relationships among the concepts.

D.4.1.1.1 Discriminations. Discriminations are skills related to seeing differences between stimuli. Most adult problems in discrimination come from physical disabilities like color blindness, hearing loss, or some injury that affects sensory perception.

D.4.1.1.2 Concrete concepts. Concrete concepts are skills related to categorizing physical objects into one or more classes based on their physical attributes. Identifying resistors from among other electrical components is an example of concrete concept learning.

D.4.1.1.3 Defined concepts. Defined concepts are skills related to classifying symbolic objects into one or more classes based on a definition. The definition is actually a rule for classification. For example, classifying a verbal statement from an officer as a command is an example of a learned defined concept.

D.4.1.1.4 Rule learning. Rule learning skills relate to applying principles or procedures to solve problems. Problem solving is the ability to recall relevant rules and use them to solve a unique problem. The product of problem solving is not only a solution to the problem, but also learning a new rule or procedure to be used if a similar situation should arise in the future.

D.4.1.2 Verbal information. Verbal information is the learning of names and labels that can be verbalized. It is also called declarative knowledge. Verbal information learning requires some basic language skills. In addition, verbal information is more readily retained when it is learned within a larger context of meaningful information.

D.4.1.2.1 Cognitive strategies. The basic premise of an information processing model is that individuals mentally process their environment. This process consists of a number of stages in which the stimuli becomes information, which is given meaning by previous knowledge and current expectations. Cognitive strategies are employed to maintain the knowledge in short-term memory and translate it to a structure that enters long-term memory as a type of knowledge in the form of propositions, productions, or schemas. There are different types of cognitive strategies such as clustering items into similar groups to reduce memory load, reading strategies to increase comprehension, and others. Good students have a variety of strategies they can use to process new information.

D.4.1.3 Motor skills. Motor skills are learned behaviors that involve the smooth coordinated use of muscles. Motor skills most often involve a sequence of activities that may be described verbally as an "executive subroutine." This verbal provides guidance for learning the execution of the motor skill. When the student has acquired the motor skill, the verbal routine is no longer needed and the skill is performed in a smooth and continuous manner. Motor skills may be learned by modeling, as when a coach shows a student how to swing a golf club. Motor skills require practice and kinesthetic (natural) feedback. Verbal feedback from an observer also helps the student make corrections in performance. Much of the instruction is aimed at getting the student to recognize the feel of the motor performance when it is executed correctly.

D.4.1.4 Attitudes. The acquiring of particular attitudes may require the prior learning of intellectual skills or particular sets of information. For example, if a positive attitude toward safety is to be acquired, the student should have intellectual skills (concepts and procedures) associated with safety, and a variety of verbal information about the advantages of following safety procedures or the consequences of not following them. Attitudes are learned by observing others and viewing the consequences of their behavior. This mode of learning (vicarious) is a

distinct principle of social learning. External conditions for learning attitudes include a human model. Experiences play a major role in the formulation of attitudes.

APPENDIX E

MEDIA FEASIBILITY DETERMINATION

E.1 SCOPE

E.1.1 Scope. This appendix provides a job aid for performing a media feasibility determination.

E.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

E.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

E.4 MEDIA FEASIBILITY DETERMINATION JOB AID

E.4.1 Use of the media feasibility determination job aid. Media selection takes place during the design phase of the ISD/SAT process. After media is selected, as detailed previously (see 7.10), an analysis should be conducted to determine that the media selected is feasible. Table 54 should be used to determine if the media selected is supportable and will actually meet the requirements. Items with an asterisk (*) indicate items that, by themselves, could be reason to re-evaluate the media selected. In addition, a significant number of "no" answers could be reason to re-evaluate the media selected.

TABLE 54. **Media feasibility determination job aid**.

ITEM	QUESTION	YES	NO	NOTES
Is it a practical solution to requirements?				
1.	Can the critical tasks be taught, exercised, and evaluated using the selected media with the specified level of fidelity and instructional features?			
2.	Are the proposed number of units of training media matched to future requirements?			
Is it a practical equipment solution?				
3.	Is there something already available, or that can be easily modified that will meet the requirement?			

TABLE 54. **Media feasibility determination job aid - Continued.**

ITEM	QUESTION	YES	NO	NOTES
4.	Can operational equipment be transferred or converted for use in training? Is it feasible and desirable to support operational equipment for this purpose?			
5.	Is it a one-of-a-kind piece of training equipment that will be difficult to support?			
Is it a practical equipment solution?				
6.	Will a simpler approach work?			
7.	Can it be done in the same manner as it's been done in the past?			
8.	Is the technology mature, or is it high risk technology?			
9.	Will the system be user friendly?			
10.	Is the technology going to be outdated before the system is fielded? Is it easily updated?			
11.	Is the computer software in the proposal compatible with the software of other devices to which it must be merged?			
Is it a practical personnel solution?				
12.	Does the media require dedicated instructor/operator personnel and additional maintenance personnel to achieve the training goals? Where will the Service get required manpower?			
13.	If the program calls for Government personnel to develop materials, are necessary skills and resources available?			
14.	Is it realistic to think that the prospective users will use the media at the proposed locations?			
Is the proposal a practical response to policy?				
15.	Is there communication with the combat developers on this issue?			
16.	Is it a defensible solution in terms of the expectations and policies of senior officials who must approve the plan?			
Is it a practical response to project timing?				
17.	Can the media be budgeted, contracted, built, courseware developed and instructor/operators trained in time for required start of training?			

TABLE 54. **Media feasibility determination job aid - Continued.**

ITEM	QUESTION	YES	NO	NOTES
	Does the strategy meet needs?			
18.	Does the macro training strategy support operation, maintenance, tactical employment, and support of the end item?			
19.	Does the strategy adequately support individual and collective training?			
20.	Does the strategy adequately support training via Service schools, units, and distributed training for both active and reserve components?			
21.	Does the strategy support initial and sustainment training?			
22.	Can the solution be proliferated during a mobilization?			
	Does the strategy respond to policy?			
23.	Does the strategy respond to Service policies that guide the design of training, such as when to use embedded training and the ISD/SAT process?			
24.	Does the strategy realistically consider the trade-off between simulators vs. operational equipment as it relates to range requirements, weapon range, and use of lasers?			
25.	Is the proposed media responsive to the Service's long range plan?			
26.	Have the long lead-time residence school resources and requirements been identified in the planning documents in a timely manner?			
	Does the strategy provide for evaluation/certification?			
27.	Have required performance proficiencies been established?			
28.	Is there a plan for documenting training effectiveness?			
29.	Will performance on the simulator/simulation be acceptable for the purpose of certifying individual or collective proficiency?			
	Is it a defensible plan?			
30.	Is there a clearly stated deficiency?			
31.	Are users identified? (including active and reserve components)			
32.	Is there a clearly stated functional description?			
	Is it a defensible consideration of alternatives?			
33.	Does the equipment reflect current MILSPECS?			
34.	Have alternatives been considered?			

TABLE 54. **Media feasibility determination job aid - Continued.**

ITEM	QUESTION	YES	NO	NOTES
Is it a defensible consideration of alternatives? - Continued.				
35.	For each alternative, have the following factors been considered? • Most important cost factors. • Personnel to operate and support training system. • Need for Military Construction (MILCON). • Need for minor construction or renovation. • Design feasibility. • Acquisition time. • Logistics support. • Reliability, availability, maintainability.			
36.	Is the selected alternative a credible choice?			
Does it support ongoing defense of program?				
37.	Does the requirements statement contain the words necessary to keep the door open to be able to obtain future required training support?			
38.	Are the right words (REQUIRED vs. DESIRED) used in the requirements statement?			
39.	Is there effective communication with support personnel?			
40.	Is the approving authority designated? Is that person clearly knowledgeable on training issues?			
41.	Do we have the necessary authority during system acceptance tests?			
42.	Are we one of the signatories on the program acceptance documents? (DD FORM 250)			
What are the costs?				
43.	In which areas can I expect substantial cost reductions? • Rounds. • Miles/flying hours. • Spare parts. • Additional units of end item released from training. • Reduced maintenance cost.			

TABLE 54. **Media feasibility determination job aid - Continued.**

ITEM	QUESTION	YES	NO	NOTES
What are the costs? - Continued.				
44.	What life-cycle costs will I incur? • Development. • Production. • Product improvement and media update. • Maintenance costs beyond warranty. • Annual operation. • Manpower to operate and maintain the selected media.			
45.	What additional costs, manpower, and support will be needed?			
46.	Is new construction required over that already planned for the existing training system? What are the new construction estimates? Can new construction be completed by the time the selected media is fielded?			
What are the benefits?				
47.	How will the acquisition of this item improve training efficiency? • Enhanced safety. • Improved training effectiveness. • Fewer units of operational equipment for training. • Reduced time to certify or qualify students. • Increased student throughput.			
48.	How will this item be resourced? Must the item compete with other media for a funding priority? What is the likelihood that it will be resourced within the next two fiscal years?			
49.	What is the impact if not procured?			
What is my level of confidence in this solution?				
50.	Are there adequate studies/analyses to support a decision to procure the media for training?			

CONCLUDING MATERIAL

Custodians:
Army - AV
Navy - AS
Air Force - 94
Marine Corps - MC
DLA - DH

Preparing Activity:
Navy - AS
(Project SESS-0016)

Review Activities:
Army - TM
Navy - SH, EC, TD
Air Force - 11
NSA - NS
DLA - CC, GS, IS, DP

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** **MIL-HDBK-29612-2A**	**2. DOCUMENT DATE** (*YYYYMMDD*) **20010831**

3. DOCUMENT TITLE
INSTRUCTIONAL SYSTEMS DEVELOPMENT/SYSTEMS APPROACH TO TRAINING AND EDUCATION (PART 2 OF 5 PARTS)

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include ZIP Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) DSN (*If applicable*)	**7. DATE SUBMITTED** (*YYYYMMDD*)

8. PREPARING ACTIVITY

a. NAME COMMANDER NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION	b. TELEPHONE (*Include Area Code*) (1) Commercial (732) 323-2947 (2) DSN 624-2947
c. ADDRESS (*Include ZIP Code*) CODE 414100B120-3 HIGHWAY 547 LAKEHURST, NJ 08733-5100	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888